SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

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THE BRAYTON READY MOTOR OR HYDROCARBON ENGINE.

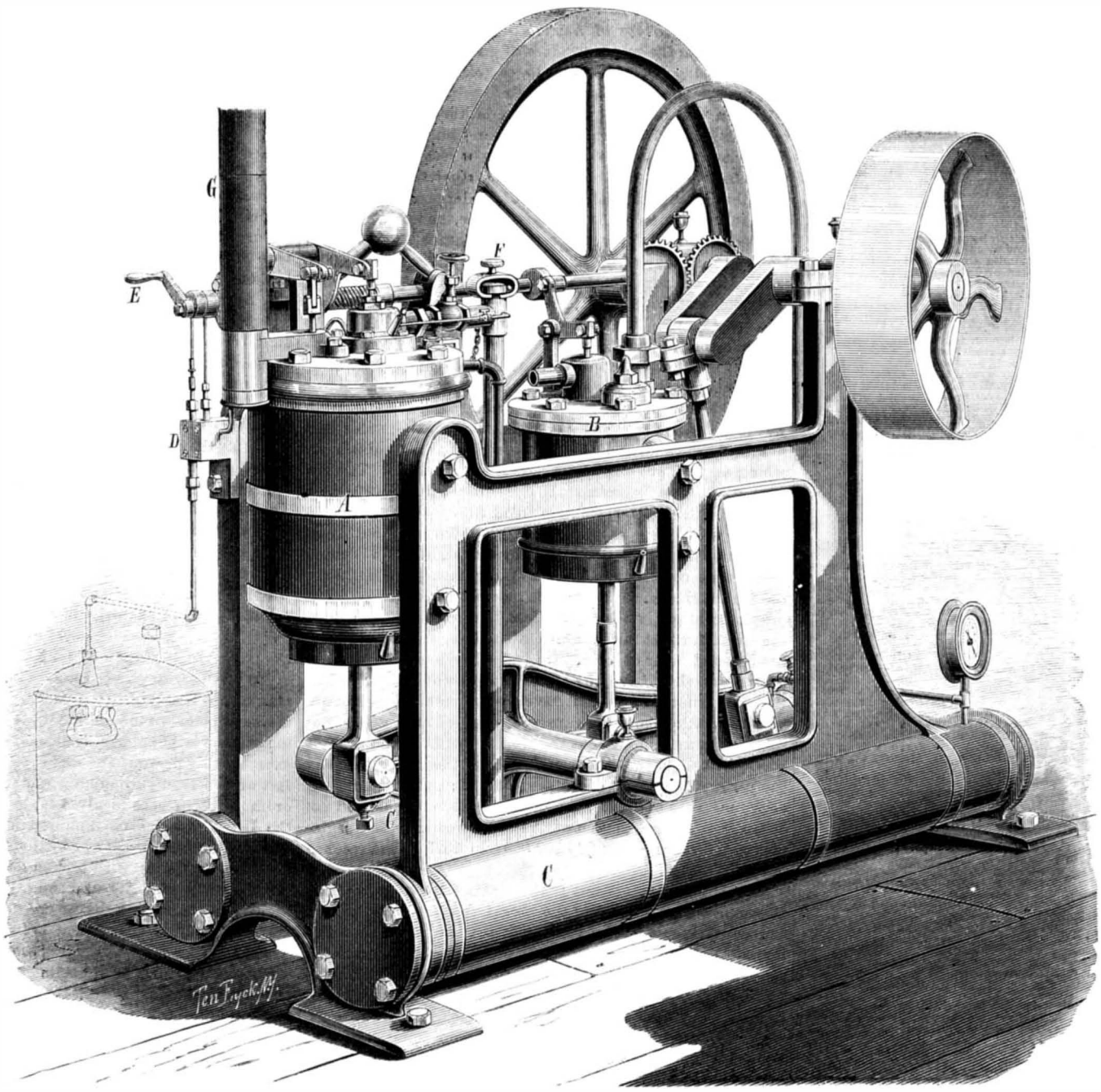
Our engraving represents the Brayton hydrocarbon engine described by us not long ago as being in successful operation in this city. The distinguishing features of this engine are that it can be started in a very short time, that it is economical in its consumption of fuel, and that, owing to the constant maintenance of combustion, it is claimed, the danger of explosion of the hydrocarbon vapor is so greatly reduced as to be practically obviated.

The consumption of the crude petroleum used in this engine is stated to be five gallons per day for a five horse machine, the duty performed by a five horse engine in use being the grinding of 600 bushels of malt per day of ten hours. The ease with which the motor may be handled will be appreciated when we state that those run for our inspection were started, without any previous preparation, in one minute, the proprietors starting the engine themselves, not having an engineer in their employ. Another important feature of the motor is that the consumption of fuel ceases the instant the engine is stopped, the stoppage being effected by simply shutting off the supply of air.

In our engraving, A is the working cylinder of the engine, which is jacketed by a water cylinder. B is an air pump actuated by the working cylinder, and employed to compress air into the two reservoirs, C C, constituting the base of the frame. D is a pump which supplies the petroleum or other suitable fuel, as fast as it is needed for combustion. The action of the engine may be thus briefly stated: The oil pump feeds a few drops of liquid fuel through a small tube into an annular chamber containing felt; here the petroleum encounters a supply of compressed air by which it is vaporized; the mingled air and vapor are forced in proper proportion into the working cylinder, where the combustion takes place, communication with the annular chamber being cut off and the products of combustion being left to work expansively, driving the working piston downwards or towards the end of the stroke; the compressed air supply to the working cylinder is cut off, thus extinguishing the combustion therein; the opening of the exhaust valve permits egress to the products of combustion, and the stroke is completed. An independent jet of hydrocarbon, burning continuously in a suitably provided chamber, lights the hydrocarbon in the working cylinder at the commencement of each stroke. The supplies of air and oil are, by very simple means, adjustable, thus giving to the engines all the advantages of a variable cut off, and thus effecting an important saving in fuel when the engine is not required to work up to its full capacity. Ordinarily but one of the reservoirs, C C, is employed, the other being kept charged in order to allow of the immediate starting of the engine at any desired time.

The engine is substantially built, the crank and the beam, and the central shaft upon which it works, being made of cast steel. The working or air piston may be removed, when necessary for repairs, by simply disconnecting the connecting rod from the working beam; and by the removal of the bearing caps, the crank and the beam may be removed, leaving the engine stripped of its main parts, and giving access to any part which may need repair or renewal. The bearing and working surfaces are large in proportion to the amount of duty required of them, thus making the engine substantial and not subject to undue wear.

This motor is the invention of Mr. George B. Brayton, who has spent many years in its development and practical application. Sizes of three, five, and ten horse power are now built, and motors suitable for steam yachts and other special purposes are being designed. A one and a ten horse motor will be on exhibition at the Centennial Exposition. For information, address the Pennsylvania Ready Motor Company, 132 North 3d street, Philadelphia, Pa.



THE BRAYTON HYDROCARBON ENGINE.

New Electrical Instrument.

This instrument is termed Marianani's *rhé electromètre*, and is intended for the investigation of electrical discharges between the atmosphere and earth. It consists essentially of a coil of copper wire turned round a pasteboard tube, and carrying a traversing magnetic needle mounted upon a vertical pivot immediately above the coil. The apparatus is so placed that the magnetic needle is ranged north and south by the earth's magnetism, and that the coil then crosses its axial line at right angles. A small iron bar is inserted as a core within the axis of the coil. Whenever a spark of electrical discharge of high tension passes through the coil, the internal iron bar becomes a magnet, and deflects the magnetic needle traversing above, the deflection of its north point being to the east or to the west, accordingly as the spark passes in one or the other direction through the coil. When the iron bar has been thus magnetized by a spark, it has to be deprived of its magnetism by heating before the instrument is used with it again for a fresh observation. But a number of fresh neutral bars are kept always on hand to be employed in succession.

This instrument is very sensitive. A very slight spark from an artificial electrical machine, or even from an electrophorus, suffices to give magnetism to the core, and to cause deflection on the traversing magnet. Its cost does not exceed $2, and Professor Melsens is very sanguine that it will prove a useful instrument for an extended investigation of the changes and intensities of atmospheric electricity. The instrument is now used in the telegraphic offices of the Belgian lines, and formal official returns are made of the discharges which are indicated by it. The coil is placed in continuation with the earth wires, which are provided for the protection of the instruments in the telegraph offices. Professor Melsens states that the magnetic needles in the offices furnished with the apparatus are deflected briskly by a lightning discharge, and that they are not infrequently recalled to zero, either briskly or gradually, by a subsequent discharge. Occasionally the deflection is reversed by the second discharge. Professor Melsens finds that ordinary commercial iron wire serves generally for the construction of the iron bars for the core. He has more difficulty in procuring iron that can be satisfactorily made neutral by heat than in finding iron that gives ready indications of the disturbance. He desires very much that this simple and cheap instrument should have an extended trial among telegraphists as a convenient means for investigating the movement, conditions, and rate of progress of atmospheric disturbances.

The instrument, which was lately shown at the Meteorological Society, will be included in the loan exhibition of scientific instruments about to be opened at South Kensington, London, England.

A Bi-Centennial Relic.

Professor Edward J Young, of Harvard College, recently delivered an historical address at Sudbury, Mass., giving many incidents of much interest pertaining to the town, and particularly to King Philip's war and the battle fought at Green Hill. He referred to some relics in that town, one of which was described as follows: "The dwelling now owned by the venerable Mr. Willard Walker, which was built by his great-grandfather 200 years ago, and which has been in the possession of the family ever since, is almost entirely unchanged. There is one beam in this house measuring 12 by 14 inches. The building is covered on all sides with 4 inch plank or pitch pine, which is set up endwise and reaches to the roof, and is held on the inside by wooden pins. It is thus made bulletproof. The chimney, likewise, is immense, and has several enormous flues, while the fireplace was large enough to contain logs that were eight feet long. The windows were originally of diamond-shaped glass set in lead, but these have been removed. It is a relic which ought never to be destroyed. No money ought to be able to buy it."

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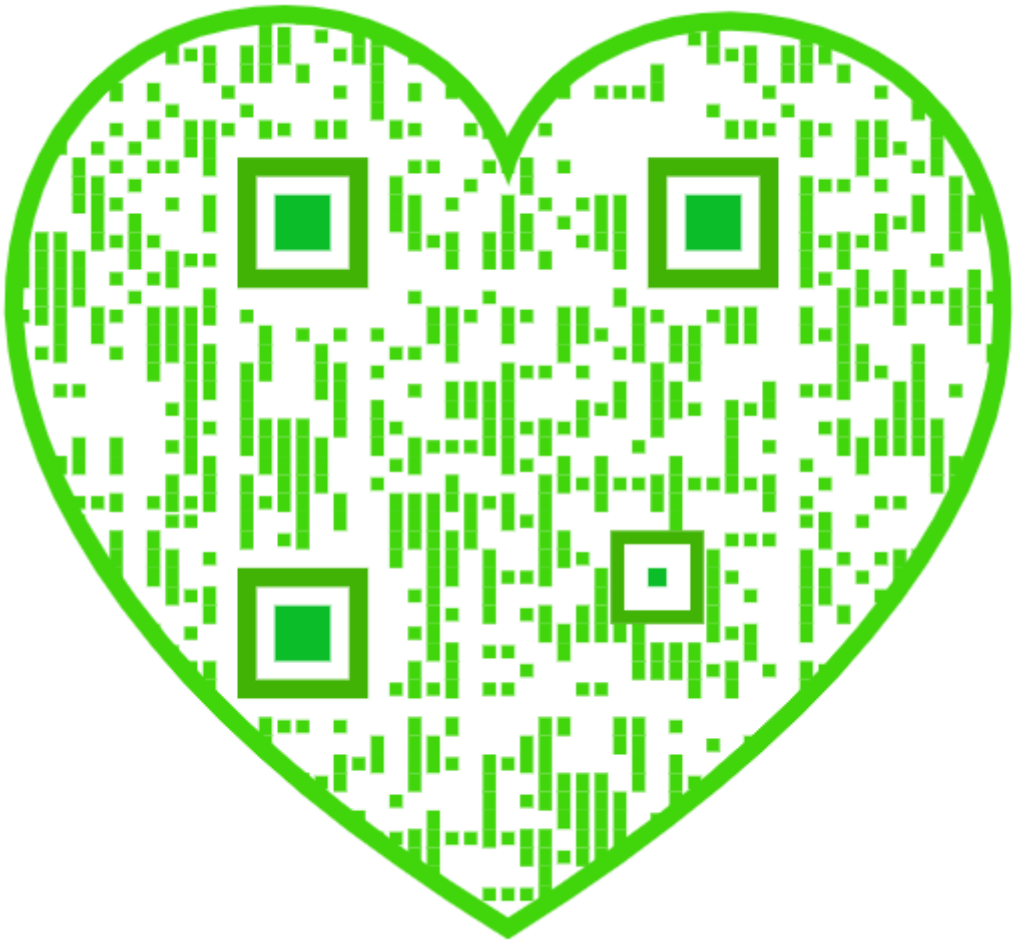

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NEW YORK, SATURDAY, MAY 13, 1876.

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A CENTENNIAL NUMBER.

In commemoration of the opening of the Centennial Exposition on the 10th of May, the next number of the SCIENTIFIC AMERICAN will appear in a new dress, and its pages will be devoted to illustrations of some of the various buildings, national, state, and those devoted to special industries, which together constitute the miniature city now almost completed in Fairmount Park. In the succeeding number we shall present a full account of the opening ceremonies, together with illustrations thereof, and interesting descriptions of matters and things connected with the event.

At the present time, beyond the brief report of progress which will be found in another column, it is an impossibility to afford any idea of the contents of the Exposition. Two sets of workmen, numbering many thousands, are working continuously, night and day, evolving order out of a chaos which appears to be continually augmented by fresh contributions pouring in at the rate of hundreds of car loads daily. As soon as affairs run smoothly, and the entries are in such condition as to admit of proper examination, our readers may look for complete accounts of all matters likely to prove of utility or interest.

SILVER AND GOLD MONEY.

On February 12, 1873, Congress passed an act by which the gold dollar was made the unit of value, the trade dollar of silver, weighing 420 grains, established, and silver money rendered no longer a legal tender for sums exceeding five dollars. The effect of this measure is, it is claimed, practically to demonetize silver, and a bill to amend it, by making silver a legal tender up to sums of $20, is now before the Senate. The chief supporter of the amendment is Senator Jones, of Nevada, who represents one of the greatest silver-producing districts in the world, and who has recently made an able speech in behalf of a silver currency. From a review of the mutations and quantities of the precious metals, from the earliest times to the present, it appears that any diminution of the stock of specie, whether resulting from failure of mines or from arbitrary legislation, is fraught with the greatest disasters that can befal society. England, said the Senator, by making gold the only standard of value, in 1816 was brought to serious financial straits, only relieved by the discovery of gold in California, and this, despite the fact that gold was a peculiarly British product. By existing laws, the United States is committed to resumption in specie, combined with a demonetization of silver, and Senator Jones believes this to be an impossibility, and that one or the other course must be abandoned. As no one, save those committed to the inflation heresy, will dispute the necessity of early resumption of specie payments, it follows that silver must be brought to the level of gold; and it is in support of this view that the Senator addresses a valuable array of facts and figures, some of the more striking of which we quote below:

From the discovery of America up to 1873, it is a remarkable fact that the relative values of gold and silver, 15½ lbs. of silver being equivalent to 1 lb. of gold, have scarcely varied, and it is probable that similar stability will be maintained in the future. The reason is that the nature and qualities of the two metals are so nearly alike that any improvement applicable to the extraction or recovery of the one must be applicable to the other; and further, their geological distribution is such that in many of the largest deposits they lie in the same matrix. At the present time, the world's store of specie is one half silver; the estimated figures in 1872 were: Gold, to the value of $5,800,000,000, and silver, $5,600,000,000. As a matter of curiosity, we have calculated, roughly, the volume of each metal, supposing each could be melted into a solid mass. The gold would form a cube only 27 feet in each dimension, and the silver, one of 177 feet. A medium-sized room, therefore, would hold all the gold in the world. The gold supply is, however, diminishing; the river beds of California and Australia, the Senator says, "have been washed, the surface gold has been secured, the water line has been worked, and below it are only those sulphurets which as yet have not been successfully treated." The annual production in gold in 1801 aggregated $13,000,000 a year, in 1829 $5,000,000, in 1852 $182,000,000, in 1875 $97,500,000. This shows, not only a falling off, but great fluctuation in production; and, moreover, in 1875 British possessions contributed $60,000,000 against $26,000,000 for the United States, so that gold is now a British product. The present gold product is insufficient to meet the demands of the world for that metal in use in the arts, and to keep good the loss and wear of coin. On the other hand, in marked contrast to the above, the annual supplies of silver, essentially an American product, have always been steady and are now but little above the average. In 1805 the average of coin *per capita*, throughout the world, was $2 83; in 1862 it was $4.75. Between these periods both the production and the *per capita* rate of coin have doubled; and this swelling of the measure of value lies in the increase of gold and not of silver. The production of the latter metal at the beginning of the century was $35,000,000; in 1875 it had reached but $72,000,000.

Senator Jones points out that it is the stock of precious metals in the possession of the world that measures prices; and as nearly one half of this stock is silver, to demonetize the latter would be to reduce all prices one half, and convulse every country in the world except those which may refuse to take part in such demonetization. Further more, he insists that we never can resume specie payments by gold alone. By continuing to exclude silver from equal participation with gold in the United States currency, and attempting to resume specie payments, we occasion a demand, say of 350,000,000, to pay off the greenbacks and furnish bank reserves and $50,000,000 of silver in lieu of fractional notes. The quantity of precious metal needed to maintain prices at their present level in the occidental world is $4,000,000,000; and of this, if the United States succeeds in resuming specie payments, it must hold $350,000,000 in gold. It is impossible for the country to obtain this by 1879, with the present production of gold only at $97,500,000; more than half of this yearly yield is needed in the arts, and 1½ per cent of the occidental stock of gold, $2,600,000,000, is needed for the maintenance of money, to pay for the abrasion and loss. Deduct these sums, and there is a surplus of $10,000,000 a year, whence to obtain our $350,000,000, so that at least thirty-five years will be needed to amass the amount. But the increase of population will make an increased demand for gold exchanges and use in the arts, equal to at least $6,000,000 annually; and the annual gold product is, besides, diminishing. When these elements of the circulation are all moderately provided for, there will remain perhaps $500,000 a year surplus, and we shall be 700 years getting our $350,000,000.

With these difficulties, the Senator contrasts the ease with which specie payments could be resumed on the basis of the double standard of gold and silver. The total coin in the world is $5,700,000,000, and the annual supply of both metals to draw upon is $170,000,000. Instead of having to draw upon the occident alone, we should draw upon the whole world. Three hundred and fifty millions in gold forms one seventh of the entire stock of that metal; the same sum in both metals is less than one sixteenth. If a draft of one seventh would occasion a fall in prices of 15 per cent, a draft of less than one sixteenth would occasion a decline of less than 6 per cent; and while 15 per cent during two and a half years—equal to 6 per cent per annum—would sweep away all and more than all the profits of industry, which on the whole do not net more than 3 or 4 per cent, 6 per cent in two and a half years—equal to 2⅔ per cent per annum—would enable us to get back to a sound measure of values without the loss of more than a very small portion of our industrial profits.

LA GRANDE CHARTREUSE.

Although modern society has generally concluded that the usefulness of the monastic life has long since passed away, there are many precious legacies in art and literature, which, born and nurtured in the cloisters of the middle ages, have descended to these times. When the outer world was given over to rapine, and the favorite amusement of men of wealth and high birth was highway robbery, it was surely a good thing that men desirous of cultivating the arts and sciences, and of keeping alight the sacred flame of literature, should find retreats which the wildest marauder respected, and which, moreover, were centers whence many streams of charity and benevolence took their course.

The ancient order of Carthusian monks was celebrated through many centuries. St. Bruno and six of his disciples repaired, about the year 1080, to the beautiful country watered by the Rhône and the Isère, in the southeast of France, and there founded the monastery called La Grande Chartreuse which is to this day the headquarters of the order. Another important organization occupied the site of the Charterhouse schools and asylum in London, the name of which is obviously derived from the monastery. The worthy ecclesiastics are now, however, appearing by their attorneys in our courts to defend their right to a trademark affixed to the bottles of a cordial of great delicacy called "chartreuse," for the manufacture of which the monks are justly celebrated. Some base imitators in this city, it appears, have adopted the trademark, and, by foisting a home-made article on the market, have brought discredit upon the old Carthusians. But Judge Shipman, after hearing argument in the case, at once directed an injunction to issue, and the bogus traffic will now be stopped.

It seems singular that so ancient and venerable a body should appear in the forefront of our modern civilization, claiming its rights like any manufacturer or inventor of our day. Much of the art, learning, and literature, so carefully nursed by the monks of bygone days, has passed away, and their science has long since gene, no one knows whither. Their houses and lands are, even in Italy itself, given over to secular purposes, their numbers are reduced, and there is little left of many of their orders but the names; but there still remains in all its force, protected by the ægis of the United States Patent Office, their capability of producing potent liquids of exquisite flavor.

WORRY AND ITS PHYSICAL EFFECTS.

To so every-day and common a state of mind as worry, ranging, as it may, from a passing "fit of the blues" up to the most poignant mental anxiety regarding life itself, little importance is popularly attached; and especially among so exceptionally nervous and rapid people as the Americans, the fact of a person succumbing under mental strain is of too ordinary occurrence to give rise to extended comment. To the list of the insane immured in asylums and brought thither through heredity or by their own excesses, thousands are added, suffering with broken minds induced by anxiety; but the great majority of people thus affected continue in their places in society, by no means lunatics, nor maniacs, nor idiots, but nevertheless of brain unsound in parts. The world sometimes dubs them "eccentric;" and, if they be distinguished, their odd habits, absence of mind, and like traits furnish rich material for the biographer; in other cases the eccentricities become crimes, and indiscriminating justice may declare the life forfeited because of the workings of hidden faculties, uncontrollable, because disorganized.

Worry, then, is dangerous, more so than the alcohol which kills the drunkard, for the latter involves a taste and a habit which may be put aside; the former is the creature of necessity, and creeps insidiously into every man's life. Its physiological effects, therefore, should be clearly and adequately realized. And the knowledge of the ills may, in some instance, prevent the existence of the cause.

During the early stages of dementia induced by mental anxiety, Dr. Richardson tells us in his "Diseases of Modern Life," there is nothing more than an increased tension of the minute vessels which supply the brain. In later stages, the substance of the nervous tissue itself undergoes a modification by which its activity is permanently lost. These are the physiological consequences, most briefly summed up. The first symptom is a want of full bodily vigor; then follows craving for more work, disturbed sleep, acute sensitiveness to external impressions, and, finally, strange figures and sounds are seen and heard. This condition may continue for years, and the sufferer in time may begin to accept abnormal creations as natural. Dr. Richardson cites a case of a merchant, who for weeks retained in his vision the spectra of three lights, oval in shape, of the size of an egg, and so clearly defined to the observer that he would watch them half consciously as they floated before him on the wall, the ceiling, or in space. In this stage of the disease lies the

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foundation of all hypotheses of ghost-seeing, of ecstatic visions, and even of poetic frenzy. A curious instance directly in point, which came to our notice very recently, is that of a well known writer on the press, who, for some time past, has devoted attention to the subject of morbid mental conditions. This gentleman, in a letter to a daily journal, states himself to be the victim of the horrible spectacle of two men hanging from a gallows, a sight which he once beheld while acting as a city reporter. The suspended corpses are clearly brought before him by the sound of rain (the execution occurred during a rainstorm), and also by the sound of laughter, since, through some uncontrollable impulse during the hanging, he was induced to utter an untimely peal of merriment. That the writer's brain is injured, possibly by the excessive mental strain peculiar to his profession, seems probable; and the lesion is manifested, as already described, by the constant recurrence of the apparition.

It is a well known fact that we have two natures, one purely organic and emotional, the other subject to the reasoning powers. The organic nervous chain exists in the body as a link between emotional mental acts and vascular supply. An impression from without, made through the organs of the senses upon the emotional centers, is reflected directly from them to the vascular expanse. The part flushes or blanches, and the heart hesitates, palpitates, rebounds, or intermits; so that these centers, excited by anxiety, or grief, or joy, or sorrow, influence the waves of blood passing through the system, and the brain promptly feels the imperfect regulation of the supply. Under varying tensions of the vessels, there are flashes, chills, coldness of the extremities, and other oppressive symptoms, while in addition appear the distressing ringing or hammering sounds in the head. These sounds are arterial murmurs, vibrations of the blood which presses with each impulse of the heart on the bony surroundings of the relaxed carotid canal, situated at the base of the skull. The canal is in direct connection, by solid conducting substance, with the organs of hearing, and thus the faintest vibration is detected. The sound produced when it is sudden and unexpected, as in moments of fear, is occasionally mistaken for a sound proceeding from without with no obvious cause.

Thus the sufferer is likely to see visions and hear strange noises, impalpable so to speak, but as purely physical as the most common things in life. In some instances they are actual perceptions of real facts or objects, caught by an extremely susceptible and delicate nervous surface. In others they are an intensified recognition of movements within the body; but in the vast majority of instances they are actual impressions made at some time on the organism and now recalled and rendered more definite by constant recurrence.

At this point, if the mental powers be allowed rest and the fountains of care be closed, recovery may take place; but if the over strain continue, the disease assumes still graver form. There is a maddening desire for work, more work, coupled with the sad sensation that the physical powers are failing; and then there are lapses of memory. The man of business forgets important details, he is irritable, distrusts everybody and himself most, makes mistakes, and yet persists in accumulating more work on himself. The poet and novelist become over sentimental and morbid; the man troubled with remorse for guilt confesses his crime, or commits suicide. The downward course is rapid; in one case epilepsy occurs, in another paralysis, a third developes some hereditary malady like cancer, a fourth dies from nervous failure and local disease of some vital organ. The majority, escaping these special ends, become prematurely old, and sink helplessly into death. The brain becomes disorganized, the balance is broken, and anarchy succeeds to what once was order.

"In every brain, in fact, there is set up primitively a kingly force, to which all other forces bend. The king may be good or bad, he may be an hereditary king or a usurper, but he holds the balance; kill the king, and, in ninety-nine cases out of hundred, the kingdom is made chaos and dark night."

THE APPARENT SIZE OF THE MOON AT THE HORIZON.

A correspondent forwards us an article containing the views of Dr. Montucci, of Paris, on the above-named subject. As the learned doctor has expressed a wish that it be published in some widely circulated scientific journal in this country, we accede to his request, making, however, some comments on his theory.

"Everybody must have noticed the enormous size of the full moon when it rises at dusk, just when the sun has set. That it is owing to an illusion is notorious, first, because our satellite cannot undergo any real change in size during its short progress from the horizon to its culminating point, and secondly, because, whether observed at the former or the latter, the micrometric measurement of the visual angle under which it is seen is always the same. This curious circumstance has always been a puzzle to scientific men. La Place says that, since the celestial hemisphere above our heads appears to us depressed, the rays coming from the horizon must seem to us longer than those from the zenith. Other physicists, finding this explanation unsatisfactory, assert that our judgment is led astray at the horizon by the trees and houses bordering on it, and which, having a size known to us by habit, induce us to compare the moon to these objects, and so to think it larger than it is at the culminant point, where it is quite alone, without any type of comparison in the vicinity. To prove this explanation of theirs, they prick a hole through a card, and look through it at the moon on the horizon, thus covering all the terrestrial objects that might lead us astray; and in this way the moon's disk is indeed reduced to a much smaller size. In an article published in the *Memorial Diplomatique*, Dr. Montucci expresses his astonishment at finding that atmospheric refraction, the only reasonable cause of the phenomenon in his opinion, is not only overlooked in this question, but actually rejected by all school book writers on natural philosophy, as well as by graver men. The demonstration by the pricked card he shows to be worthless: 'for,' says he, 'go about in the evening and look at the gas lamps through the card, and you will find them suddenly dwindle down to pins' heads, because you reduced the radiation of light by narrowing the field of vision. In the same way, if you look at the moon, it becomes less, just like the gas flame; but do not imagine that it is thereby reduced to its culminating size. No, you cannot have two sets of weights and measures; if you look at the moon through the hole when she is at the horizon, you must do exactly the same when she is at the zenith; and then you will see her smaller than you ever saw her.' The card being thus set aside for ever, Dr. Montucci proceeds to examine whether the illusion can be brought about by a type of comparison, and he enumerates several reasons why it cannot, among which is this: When the moon rises close to a large mass of houses or a mountain standing out in high relief above the real horizon, she loses her exaggerated diameter very quickly as she goes higher up; so that, by the time she has reached the top of the prominent object, she has diminished considerably. But that object is still there, it has not changed: then how comes it that, the type of comparison being the same, the object compared has diminished? Illusion from that source cannot therefore be pleaded here. Dr. Montucci next takes up refraction as the sole explanation possible. The misty atmosphere presents itself to the eye of the observer as a concave lens; the moon is outside, and forms with the atmosphere a divergent lens, which enlarges objects on a dark ground. Hence the moon, as well as all terrestrial objects, are increased in size on being projected by refraction through the atmosphere. This view of the case, the author confirms by various experiments with concave lenses."

We must confess that the statements, reasonings, and conclusions of the writer excite our surprise, as the fact is that this curious illusion has never been a puzzle to such scientific men as have taken the trouble to consider it carefully. They all agree with La Place that the celestial hemisphere appears depressed above us, and that objects near the horizon look much further off than those near the zenith; our judgment is not led astray at the horizon by the trees and houses bordering on it, but, on the contrary, these objects give us some faint idea of the great distance of the moon, for in this case alone it becomes perceptible that the moon is so much farther off than the largest distant objects, and the comparison allows some kind of appreciation of the moon's size; while when the moon is at the zenith, there is a total lack of objects of known size with which to compare her, and we are thus led astray by the impression of a smaller distance, and so underestimate her size. The fact is that experience trains us in our judgment of distances in a horizontal direction; but when we look upward, for lack of intervening objects for purposes of comparison, we always underrate the real distances. A six foot man, at 700 feet distance, when on the ground looks to be of natural size, notwithstanding that we see his whole figure under the small angle of less than a third of a degree; but let the man be raised to the top of a tower 200 feet in hight, and let us go a little nearer, so as to see him at the same distance (700 feet) as before, and therefore under the same visual angle, or let us even increase the angle, and the man will look very small indeed. Almost every one has experienced the surprise with which we observe that the real size of any object, with which we have become familiar by seeing it always in an elevated position, is so much larger when placed on the ground than it appeared to us while elevated.

Pricking a hole in a card, and looking through it at the moon's disk near the horizon, is a very imperfect and clumsy way of effecting an otherwise good and conclusive experiment. A hole of exactly a quarter of an inch in diameter should be punched in a card, and this card placed at the end of a tube, of cardboard or other material, 28 inches long; then the hole will appear, to the eye placed at the other end of the tube, under an angle of half a degree, which is the angle under which the moon always appears to us, whether she be at the horizon or at the zenith, and when she is at her mean distance from the earth. If we look through the tube at the moon, when she is near the horizon and appears large, and also when she is near the zenith and appears small, we shall see that she is in both cases of exactly the same size, covering the hole nearly perfectly.

The only effect which atmospheric refraction can have is to lift objects, situated outside of our atmosphere, higher above the horizon than they really are, and this action increases as the objects come nearer to the horizon. At the horizon itself, it amounts to only about half a degree, the angle under which we usually see the sun and moon; so that when the sun or moon appears to touch the horizon with its lower edge, it is in fact below the same, and without the atmospheric refraction would show just a trace of the upper edge. As this refraction is greater at the horizon itself than half a degree above the same, the lower edge of the sun or moon is apparently lifted up higher than the upper edge. This has the effect of causing the luminary to appear with a diminished vertical diameter; so that it appears flattened, an appearance which has no doubt been observed by many of our readers; and this takes place to an exaggerated extent when the atmosphere was laden with vapors.

The explanation given by Dr. Montucci is by no means new, and is found in many elementary text books of astronomy. It appears in a little treatise for school use, published 40 years ago by Arago, and it has been frequently copied by other authors, as apparently the easiest mode of explaining the phenomenon; it cannot, however, stand the test of scrutiny, as the upper surface of our atmosphere, being parallel to the surface of the ocean, cannot be more curved than the ocean, but is actually less curved, having a somewhat longer radius. As, however, the surface of the ocean can be considered level for all practical purposes, the upper surface of our atmosphere may more reasonably be treated as a flat surface, owing to its larger circumference; but it can in no way be considered to act as a lens. This old theory has been so long since exploded that it is surprising to see it brought forward at the present day.

PROGRESS OF THE CENTENNIAL.

Imagine over a hundred carloads of every conceivable product of art and industry arriving daily, and an immense army of workmen working as if for dear life, early and late, and some idea of the present condition of affairs at the Centennial will be realized. That the American exhibition will be far from complete at the opening day is certain; but fortunately the same is not the case with the foreign contributions, and hence a reasonably good display may be looked for on the 10th of May.

Three new bridges are being built over the tracks of the Pennsylvania Railroad in order to complete the approaches to the Centennial grounds. One is constructed on the rigid suspension principle, another on the stiffened triangular truss system, and the third is an iron truss structure. The last is one of the largest street bridges in the country, and will cost $300,000.

A new building has been erected near the west end of the main building for a general reception room for all visitors. It contains parlors, baggage rooms, toilet apartments, writing conveniences, and telegraph and mail stations, and is the headquarters of the corps of Centennial guides.

The interior decoration of Horticultural Hall is now nearly completed, and the main hall presents a magnificent display of tropical plants. All of the garden beds have been laid out, and a large quantity of flowers are in full bloom.

The Japanese building is complete, and exquisitely furnished in a style corresponding with the better residences in Japan. The walls are elegantly papered, and the windows are furnished with a peculiar style of paper in lieu of glass.

The Chilian exhibit has arrived by steamer at Aspinwall, and will shortly reach Philadelphia. It includes a magnificent collection of precious ores, and native wines, besides a large quantity of machinery. Some of the small South American republics, not distinct exhibitors, occupy part of the Chilian space. Among these, Guayaquil has sent samples of a straw hat made from the delicate young palm leaf. It takes several months to make one hat, as it can only be worked upon by night in order to escape the action of the sun and heat. No seam or joint is visible, and each hat is valued at several hundred dollars.

The Granger's encampment at Elm Station, on the Pennsylvania Railroad, is now so nearly completed that the buildings will be ready by the opening day of the Centennial. The terms are only $1 per day for room rent and 50 cents per meal. A branch railroad line will run to the Centennial grounds, and a nominal fare will be charged. The Grangers have the preference in securing quarters, but the general public is accommodated on the above terms. Working men will probably find these accommodations very convenient.

The great 100-tun Krupp cannon has safely arrived. The principal display of war material will be found in the United States section. A very interesting feature in that portion of the exhibition is a small working model of a Hitchcock forge, which will be so arranged that at stated periods miniature guns will be actually constructed, built up from iron sections. The Gatling gun will be shown in all its modifications, and there will be a complete set of small-arm-making machinery in practical operation.

The carriage building is about finished. It is of wood sheathed with corrugated iron, and of very ornamental design. The exhibits consist entirely of pleasure carriages, as all carts, farm wagons, omnibuses, etc., will be displayed in the Agricultural Building. Palace and street cars will, however, be exhibited, together with all improved carriage appliances.

The Art Gallery is rapidly progressing, and in parts of it the hanging committee have already begun arranging the pictures. The judges' pavilion and the Massachusetts building are finished, and present a beautiful appearance. The Pennsylvania building, begun very recently, will not be completed for several days.

The London Artisans' Institution and several French working men's associations are making preparations to send delegations of workmen to the Centennial. We have as yet heard of no similar action on the part of trade associations and large manufacturing concerns in this country. We have already pointed out at some length the advantages to be gained by affording every possible facility for workmen to visit the exhibition, and certainly no other such opportunity for observation and study will be afforded our mechanics during the present generation. This country will never be able to compete with Europe in the matter of artistic workmanship until our workmen have the same advantages, in the shape of galleries and collections of industrial art, that are possessed by their European brethren. In respect to art productions, the Centennial will be especially rich; and with proper opportunity for study, American operatives can gain a fund of information and ideas which will be not only valuable to them, but directly beneficial to all our industries.

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IMPROVED AUTOMATIC TANK FILLER.

Mr. Augustus Haerle, of Cincinnati, Ohio, has recently (March 7, 1876) patented an improved device for filling water, beer, oil, and other tanks. It consists of cocks in the filling pipes, and a cock in a relief or signal pipe, attached to the filling pipe and connected with a float in the tank in such manner that the float closes the cocks of the filling pipe and opens the one in the relief pipe when the tank is full; and when the water falls a little, the float opens the filling pipe and closes the other, and thus automatically maintains the required quantity in the tank.

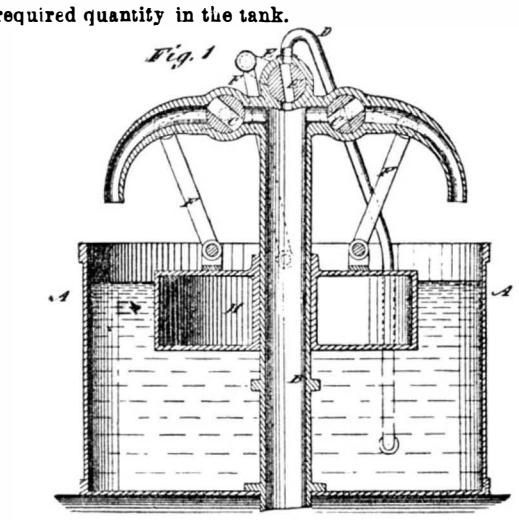


Fig. 2

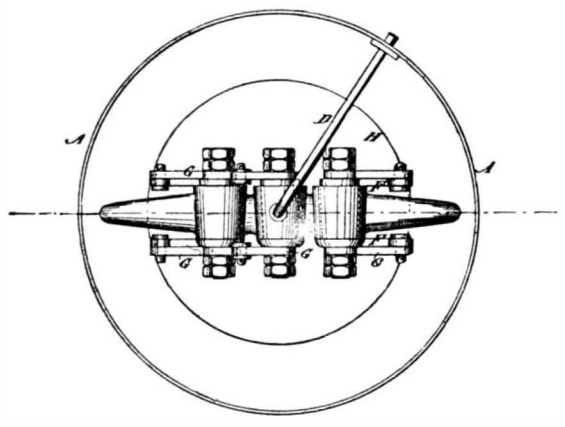


Fig. 1 is a sectional elevation, taken on the line, *x x*, of Fig. 2; and Fig. 2 is a top view. A is the tank, for water, beer, or other liquid. B is the filling tube; C, the cocks in the same for shutting off the supply when the tank is full. D is the relief or signal pipe for the escape of the liquid when cocks, C, are closed, to relieve the feed pipe of the pressure, and to show, by the liquid running through it, that the tank is full. E is the cock in the relief pipe, and H is the float. The cocks are connected to the float by an arm, G, and rod, F, which are so adjusted that cock, E, opens a little before cocks, C, close, so as not to shut off the escape of the liquid, and cause pressure to rise in the filling pipe, and in the reverse operation, the cocks, C, open a little before cock, E, closes, for the same purpose. Besides relieving the pipe, B, from undue pressure, the escape pipe, D, shows, as above explained, when the tank is full.

African Hippopotamus Hunters.

The late Dr. Livingstone, in his "Last Journals," gives the following interesting account:

"At the Loangwa of Zumbo we came to a party of hereditary hippopotamus hunters, called *makombwé* or *akombwé*. They follow no other occupation, but when their game is getting scanty at one spot they remove to some other part of the Loangwa, Zambesi, or Shiré, and build temporary huts on an island, where their women cultivate patches: the flesh of the animals they kill is eagerly exchanged by the more settled people for grain. They are not stingy, and are everywhere welcome guests. I never heard of any fraud in dealing, or that they had been guilty of an outrage on the poorest; their chief characteristic is their courage. Their hunting is the bravest thing I ever saw. Each canoe is manned by two men; they are long light craft, scarcely half an inch in thickness, about eighteen inches beam, and from eighteen to twenty feet long. They are formed for speed, and shaped somewhat like our racing boats. Each man uses a broad short paddle, and as they guide the canoe slowly down the stream to a sleeping hippopotamus not a single ripple is raised on the smooth water; they look as if holding their breath, and communicate by signs only. As they come near the prey, the harpooner in the bow lays down his paddle and rises slowly up, and there he stands erect, motionless, and eager, with the long-handled weapon poised at arm's length above his head, till, coming close to the beast, he plunges it with all his might in towards the heart. During this exciting feat he has to keep his balance exactly. His neighbor in the stern at once backs his paddle, the harpooner sits down, seizes his paddle, and backs too to escape; the animal, surprised and wounded, seldom returns the attack at this stage of the hunt. The next stage, however, is full of danger.

"The barbed blade of the harpoon is secured by a long and very strong rope wound round the handle: it is intended to come out of its socket, and, while the iron head is firmly fixed in the animal's body, the rope unwinds, and the handle floats on the surface. The hunter next goes to the handle and hauls on the rope till he knows that he is right over the beast: when he feels the line suddenly slacken, he is prepared to deliver another harpoon at the instant when hippo's enormous jaws appear with a terrible grunt above the water. The backing by the paddles is again repeated, but hippo often assaults the canoe, crunches it with his great jaws as easily as a pig would a bunch of asparagus, or shivers it with a kick by his hind foot. Deprived of their canoe, the gallant comrades instantly dive and swim to the shore under the water; they say that the infuriated beast looks for them on the surface, and, being below, they escape his sight. When caught by many harpoons, the crews of several canoes seize the handles and drag him hither and thither, till, weakened by loss of blood, he succumbs.

"This hunting requires the greatest skill, courage, and nerve that can be conceived—double armed and threefold brass, or whatever the Æneid says. The *makombwé* are certainly a magnificent race of men, hardy and active in their habits, and well fed, as the result of their brave exploits; every muscle is well developed, and, though not so tall as some tribes, their figures are compact and finely proportioned; being a family occupation, it has no doubt helped in the production of fine physical development. Though all the people among whom they sojourn would like the profits they secure by the flesh and curved tusks, and no game is preserved, I have met with no competitors to them except the *wayeiye* of Lake Ngami and adjacent rivers.

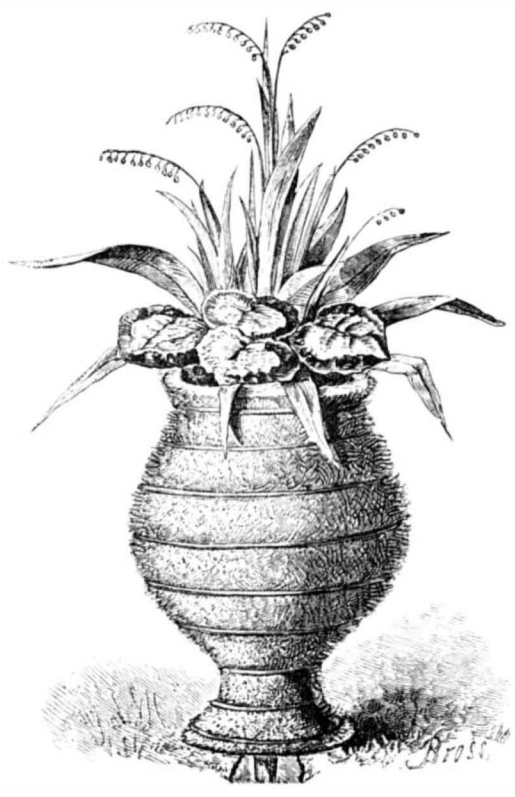
"I have seen our dragoon officers performing fencing and managing their horses so dexterously that every muscle seemed trained to its fullest power and efficiency, and perhaps had they been brought up as *makombwé* they might have equaled their daring and consummate skill; but we have no sport, except, perhaps, Indian tiger shooting, requiring the courage and coolness this enterprise demands. The danger may be appreciated if one remembers that no sooner is blood shed in the water than all the crocodiles below are immediately drawn up stream by the scent, and are ready to act the part of thieves in a London crowd, or worse."

The Solar Protuberances.

For some time past the protuberances on the sun's surface have appeared less numerous. Father Secchi states that the minimum is, however, not yet attained, and this is shown by the sudden changes in the phenomenon. On one day, scarcely more than three protuberances can be found, while on the following day they may be counted by dozens, evidencing the fact that the solar activity in course of diminution, suddenly, from some unknown cause, renews itself. Father Secchi also notes the rectilinear form of the hydrogen eruptions, which, with a thickness of several seconds, rise without deviation to a distance of two or three minutes (equal to 60 terrestrial diameters) from the sun's edge. The solar atmosphere is now so calm that the expansion, which takes place at the extremity of the incandescent columns, appears perfectly symmetrical on the two sides of every jet.

A SIMPLE FLOWER VASE.

Everybody is, perhaps, aware that a very tasteful hanging basket for growing plants can be made from a wire ox muzzle lined with sod or moss. A variety of wire baskets of



elegant patterns, for the same purpose, are also sold in hardware stores; but these, however, lack the charm which always attaches to an article which is the product of one's own handiwork. About the simplest and most ingenious plan for making flower baskets and pots which has come under our notice is that recently patented by Alfred D. Lee, of Scio, Ohio. A web or plat of sod is first cut of sufficient size to form the vessel when folded in proper shape. A mold of the desired form being previously made of wood, the sod is wrapped about it; and then turns of cord or wire, preferable the latter, are wound spirally about the exterior so as to confine the sod. The ends of the wire are then tightly secured, the mold removed, and the empty space left by the latta, filled with loam, in which the plants are imbedded. The appearance of the finished pot is excellently shown in the annexed engraving. Any desired shape can be made, and the pots themselves may be ornamented with vines and flowers planted on their outer sides. In propagating and trap-planting, the pot may be set directly in the bed, when the roots of the plant will find their way through the turf. The latter also holds water and aids in nourishing the plants enclosed.

IMPROVED MACHINE FOR STRAIGHTENING METAL BARS

In the annexed engraving is represented a new machine for straightening metal bars, which involves a novel arrangement of rollers, which, it is claimed, enables the work to be done with less power and less strain on the machinery than when done simultaneously in both directions by alternate

Fig. 1

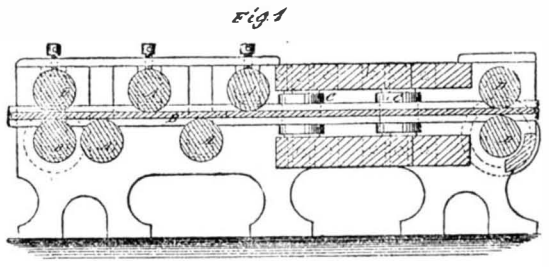


Fig. 2

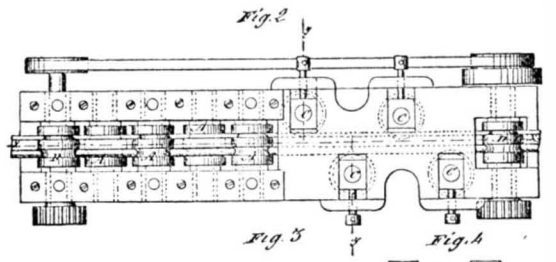


Fig. 3

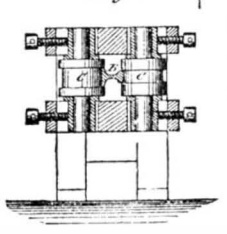
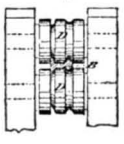


Fig. 4



horizontal and vertical rollers. Fig. 1 is a longitudinal section, Fig. 2 a plan, Fig. 3 a transverse section, and Fig. 4 an end elevation. A represents the series of horizontal rollers for bending or straightening the bars, B, vertically. C represents the series of vertical rollers for bending or straightening the bars horizontally, and D represents the drawing rollers for forcing the bars between the straightening rollers. The upper horizontal rollers are adjusted, and have adjusting boxes and adjusting screws for setting them for bars of different sizes, and the vertical rollers of both sides are adjustable for the same purpose. In this example, the rollers are grooved suitably for bending railroad rails, for which the machine is more especially designed; but it is also applicable for bars of any form, the grooves being shaped accordingly.

Patented through the Scientific American Patent Agency, February 22 1876, by Messrs. Aquila Howells, John K. Howells, and William Garrett, of Cleveland, Ohio.

Dye Leaves.

We do not remember ever having seen mention in the public prints of the leaves from which a dye is extracted. This quality in certain plants is an interesting one for the botanists who occasionally sojourn with us for awhile, hunting up orchids and other specimens of the vegetation of this locality. A study and analysis of the merits of these may be of vast worth to him who is first in the examination of the subject, and the leader in making their value known to the commercial world.

Of the leaves that are made use of by our country people is one of a class commonly called the china. From it a red tint is extracted, with which the straw hats, from the vicinity of Penonome, are dyed. To all appearances it is a fixed dye, which exposure to rain and sun does not materially alter. We are not acquainted with the secret of the mixture, that is, if there be any mordant employed to give it its fixity. If it be a fixed dye, not needing a mordant to give it a permanency and inalterability, it may prove to be of great value in commerce and the arts; for of all the vegetable dyes thus far known and tested, there is but the single exception of indigo which possesses the quality of durability without the necessity of a base or mordant to make it a lasting dye that does not fade away easily. Should this china turn out to be permanent and not readily deteriorate by the action of temperature and moisture, it may become a valuable acquisition in the manufacture of textile fabrics, and render the making up of cotton cloths something cheaper than what it is at present.

This china is a wild plant that is found in abundance i many of the mountainous districts of the Isthmus. It is a vine (*bejuco*) that attaches itself to tall trees, and the leaves are shed in the dry season. There is no trouble in collecting them, as the time of the year is propitious for such work. It is only left to be seen whether they be a fixed dye; and if that fact be established by a competent analysis, they may be made to take a place as one of the exportable products of the country.—*Panama Star and Herald.*

It is said that eggs may be preserved for six months by dipping them in linseed oil, and so placing them in a layer of sand that they do not touch.

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IMPROVED KEG AND BARREL MACHINERY.

In our last issue, we published five engravings of the improved barrel-making machinery introduced by Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N. Y. We now resume the subject, continuing it to its close, and illustrating four other machines, which complete the series.

Fig. 6 is a stave equalizer, with reel feed and conveyer. This is adapted to sawing off staves to uniform lengths as required, and will equalize staves of different lengths for making casks of all sizes, from the smallest kegs to barrels. It has a continuous reel feed and conveyer; also two circular saws upon the same mandrel, which can be adjusted and placed at different distances from each other. The stave is placed upon the feeder and is presented to the saws, which cut off both ends. The reel then carries it to, and drops it upon, the conveyer, which delivers it wherever desired.

In Fig. 7 is shown a machine for dressing and jointing headings of all lengths and sizes for casks, from small kegs to hogsheads. One or both sides of the material can be finished as desired. The machine is constructed with a heavy iron frame, upon which is mounted a large iron wheel. On the wheel are placed cutters for dressing and jointing the heading. The inner set of cutters is for dressing the heading, and the outer for jointing. There is also a sliding clamp located upon the frame, in which the piece of heading is placed and clamped, and passed up to the cutters, which dress it and take it out of wind. The piece of heading is then taken from the clamp and placed upon the jointing rest, and brought in contact with the cutters, which give a smooth and perfect surface to its edge.

Fig. 8 is a machine for jointing staves for kegs and small casks. This is so constructed that the operator can instantly change the curve or bilge of the stave, through a foot lever, by which the operator raises or lowers the clamp or rest upon which the stave is placed. The clamp is fastened by an eccentric at any point desired. The stave is placed upon the holder, and is passed up to and against a concave disk, in which are cutters which make a perfect joint upon the edge of the stave. The machine is made with or without the casing, which, in connection with the revolving disk, forms a fan, to remove the shavings and dust to the fuel room or where desired.

In Fig. 9 is represented a machine for bending and rendering flexible wooden hoops. By the operation of this device all the stubborn and unyielding portions of the hoop are rendered flexible. The hoop is put into this greatly improved condition without breakage, thus saving a large amount of valuable stock; and the work of the cooper is greatly expedited. The machine is made with an iron frame in which are placed three iron turned or finished pulleys. A strong belt is so placed upon the pulleys as to drive them all when one is put in motion. The hoop is entered between the belt and the middle pulley, which is carried around the pulley and held close to it by the belt, which prevents its breaking. Hoops are passed through this machine very rapidly.

Lack of space precludes our presenting more than the brief description here given of these valuable machines. We are informed that the manufacturers are the only parties in the United States, or in the world, who make and furnish full and complete apparatus for making all kinds of barrels and kegs. A fine representation of all varieties of their machinery will be found in section 37, columns 50. 51, 52, of the machinery department of the Centennial Exposition.

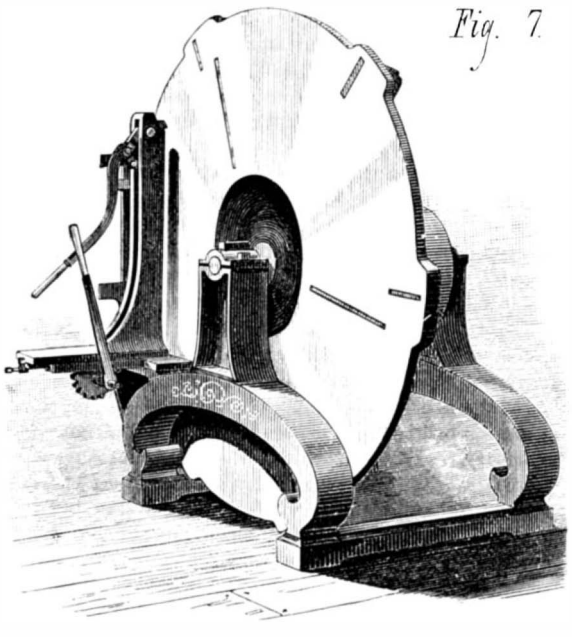

Fig. 7.—BARREL HEAD DRESSING AND JOINTING MACHINE.

For further particulars, address the inventors and manufacturers as above.

NICKEL deposits, from which ore containing 30 per cent of pure nickel has been obtained, have recently been discovered at Ouaïlou, New Caledonia.

SCIENTIFIC AND PRACTICAL INFORMATION.

HOW WE TAKE COLD.

It is one of the facts best known to Science that, when a part of the outer surface of the body has been exposed long to cold, the greatest risk is run in trying suddenly to re-induce warmth. To become thoroughly chilled and then to pass into a very warm atmosphere, such as is found near a fire, results in a dangerous reaction which, a few hours later, may cause pneumonia or bronchitis, or both diseases. The capillaries of the lungs become engorged, and the circulation becomes static, so that there must be a reaction of heat inflammation before recovery can occur. Common colds, says a contemporary, are taken in the same way: the exposed mucous surfaces of the nose and throat are subjected to a chill,

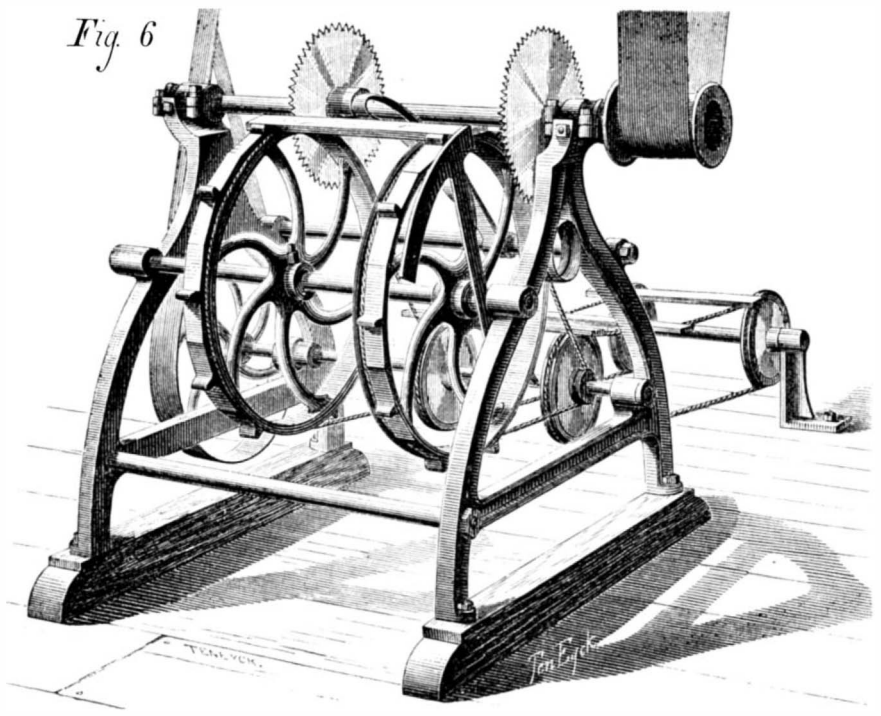

Fig. 6.—BARREL STAVE EQUALIZER AND CONVEYER.

then they are subjected to heat; then there follows congestion, reaction of heat, pouring out of fluid matter, and the other local phenomena of catarrh.

LOISEAU'S PATENT FUEL.

We have already chronicled the excellent success which Mr. E. F. Loiseau has encountered in introducing his patented process for the manufacture of fuel from the hitherto

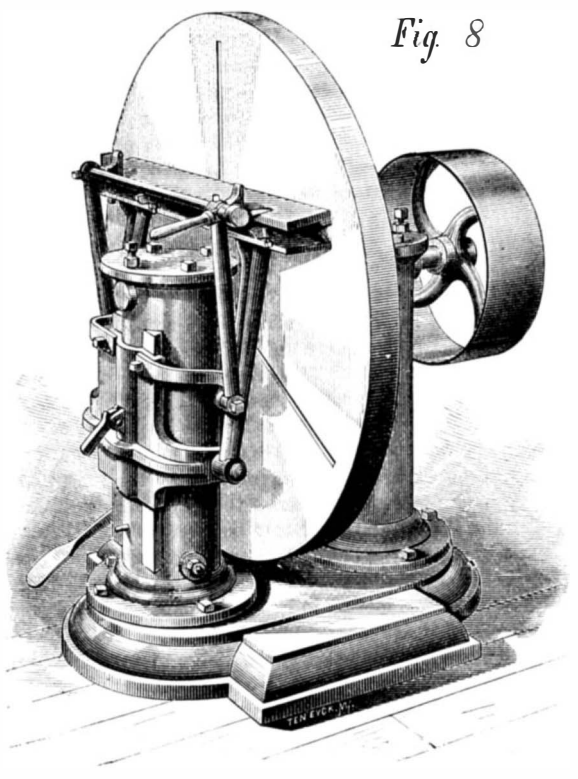

Fig. 8.—KEG STAVE JOINTING MACHINE.

wasted coal slack. Preparations are now in progress for making the the fuel on an extended scale, and supplying it for public use. A factory located at Port Richmond, Pa., has a set of Mr. Loiseau's machines capable of making 150 tuns per day, and admitting of the sale of the material at one dollar per tun less than the price of stove coal. Contracts have been entered into for immense quantities of coal slack, so that before very long we may expect to see the enormous heaps of that refuse, which now simply encumber the ground in the vicinity of the breakers in the coal districts, disappear. For several months past the Philadelphia and Reading Railroad Company has been experimenting upon the fuel, and it is found to yield more heat and produce more steam than similar quantities of large coal.

We published some time ago complete illustrations, with descriptions, of Mr. Loiseau's very ingenious machinery. The beauty of the process is its continuity: 95 per cent anthracite slack, 5 per cent clay, and some adhesive material enter one end of the series of apparatus, and the compound never stops moving until it emerges at the other end in the shape of neatly molded hard lumps, covered with a waterproof varnish, and ready for instant use.

A SUBMARINE RAILWAY.

One of the most remarkable and at the same time impracticable plans, which have been suggested for rapid and agreeable transit across the English Channel, has recently been exhibited at the Palais de l'Industrie in Paris, by its inventor, Dr. La Combe. He calls his project "the submarine boat," but the boat is really a portion of a huge carriage which is to run upon a railroad laid on the sea bottom. There is no tunnel, nor anything thereunto resembling. The road bed is of *béton*, which is to be laid by divers, and on this are fastened three galvanized iron rails. The outer ones are for the wheels of the carriage, and the inner one is raised so as to be embraced by rollers, centrally attached to the latter in order to prevent rolling and derailment.

The boat, at all points watertight, is secured to the heavy carriage, and the whole is driven by a screw actuated by compressed air transported in suitable reservoirs. The latter also supply fresh atmosphere for respiration within the boat, and a machine is provided for removing any excess, as well as the vitiated air. The interior is illuminated by the electric light, the current being led to the vessel by a wire from Dover; said wire also serves for telegraphic purposes.

The inventor proposes to arrange guard rails so as to keep the track always clear, and he provides a double-doored chamber in the vessel, so that, in case of necessity, a diver can emerge to examine the line. Should by any possibility the vessel stop, a buoy is immediately sent to the surface of the water, carrying an air tube, so that the supply of air may not fall short; and in case of grave accident, the vessel can be altogether cut loose from the carriage, when it will rise to the surface and float. A series of buoys on the surface will mark the line of the road. Dr. La Combe thinks that his project is practicable, and believes that his vessel could make the journey of twenty-one miles in about half an hour.

PURIFICATION OF SULPHURIC ACID.

The method generally employed, consisting in removing the arsenic by sulphuretted hydrogen, is tedious and costly. Professor Thorn, of Pesth, says the *Moniteur Industriel Belge*, has devised a more simple process. The acid coming from the lead chambers and marking 50° B is carried in a lead vessel at a temperature of from 189° to 212° Fah., and a quantity of sulphate of soda dissolved in water, corresponding to the quantity of arsenic contained in the acid, is added. The sulphide of arsenic is thereby formed in yellow flocculent masses, which aggregate and float upon the surface. On withdrawing the acid, the sulphide remains on the bottom of the vessel, whence it is removed. The operation is easily carried on, and but very little sulphurous acid is produced. The purified acid contains from 3 to 4 per cent of sulphate of soda, which offers, in the majority of applications, no inconvenience. In experiments made at Pesth, acid at 50° B contained 0 098 per cent of arsenic, on leaving the chambers, and 0 004 per cent after purification.

ARTIFICIAL MEERSCHAUM, HORN, AND CORAL.

A new way has been found of making excellent imitations

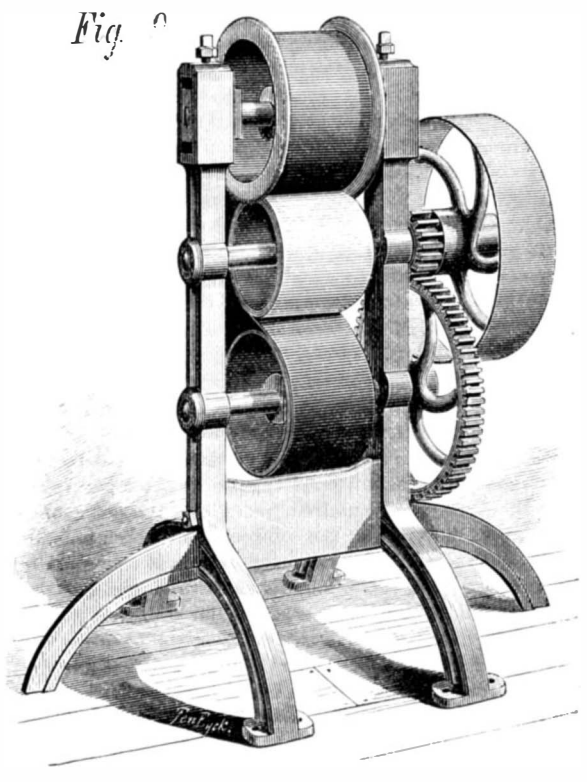

Fig. 9.—MACHINE FOR BENDING WOODEN HOOPS.

of meerschaum, horn, and coral, out of potatoes and carrots. To make the false meerschaum, the potatoes are peeled and macerated for 36 hours in water acidulated with 8 per cent sulphuric acid. They are then dried on blotting paper, and

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in hot sand under pressure upon plates of chalk or plaster for several days. The chalk supporting plates must be renewed daily. The resulting material can be readily carved. If greater durability, whiteness, and elasticity be desired, the potatoes are macerated in water containing 3 per cent of soda instead of the acid above mentioned. To produce the horn imitation,the potatoes,after being treated as last stated, are boiled in water containing 19 per cent of soda. By substituting carrots for potatoes, a good imitation coral is produced.

A REMARKABLE ERUPTION.

A curious land slide recently occurred on the line of the Hudson River Railroad near Dutchess Junction, N. Y. At about 200 feet above the Hudson river, there is a level plateau which rises slightly to the foot of a large eminence called the Sugar Loaf, and apparently is a rocky spur of that hill. Suddenly a portion of the plateau was lifted from its place and hurled, with its load of trees and shrubs, into the cove beneath, dashing up the water like a tidal wave over the railroad track and destroying the fences beside the same. A crater about 200 by 150 feet in size was left. Four hours afterward, another slide took place, accompanied by an explosion, and during the succeeding night still another upheaval occurred, which was followed by a torrent of water gushing from the crater. So great was the force of the explosions that trees nearly a foot in thickness were hurled from their places to great distances like straws; and one massive timber was driven into the solid bed of the railroad to a depth of 8 feet. The phenomenon was due to a vast accumulation of water which had formed in the sandy land. This had been fed by the watershed of the Sugar Loaf and by the recent rains, until the huge underground lake found vent with the tremendous force described. The most recent reports at the time of writing (three days after the event) state that the water is still escaping, and the land still crumbling away, a condition of affairs which will probably continue until the water has spent its force.

Correspondence.

The Cause of the Glacial Epochs.

To the Editor of the Scientific American:

It may be said of the earth that she has five distinct motions, which are these: First, a rotary motion, on an axis, say, in herself. Second, an orbital motion, on an axis, say, in the sun. Third, a retrogyratory motion, on an axis centered in the center of the sun's orbit. Fourth, a retrogressive motion round the center of the sun's orbit, and always at the same rate as Sol's motion. Fifth and last, a motion at right angles to the plane of her equator. It is by this motion that the earth's obliquity to the plane of the ecliptic is gradually becoming less and less.

It was held by La Place and several other astronomers that the obliquity of the earth to the plane of the ecliptic would ever be permanent, and that the earth would, as it were, "rock to and fro, never departing more than two or two and a half degrees from her present inclined position." We claim that there is not a power, neither in the earth nor the sun, that will sustain that idea. The earth must (and we claim that the forces in her and in the sun compel her to) revolve round an axis running through her equator, as it were from one side of it to the other: and thus comes first, say the equator, next her pole or poles, if you will; next her equator again, next her pole or poles; and so on for ever, to the sun.

It is by this motion of the earth that she has had all her glacial epochs; and the motion is not at all peculiar to the earth. No doubt all the planets have seen their glacial times, for they all revolve in the manner alluded to. See Uranus at the present hour; he is passing now through such an epoch. Fearfully grand it must be, compared to those of the earth; but it is nothing to what it would be were the plane of his equator in the plane of the ecliptic or of solar motion. No, that is the period when the vastly broad and thick sheets of ice gather over and all around his poles for many thousands of miles. Look at Jupiter, and think of the vast ice sheets which must now and for many centuries to come cover his poles and nearly one half of each hemisphere. How exceedingly thick and vastly broad must Jupiter's glacial ice fields be at this present moment.

Turning to the earth, we find, by quoting from certain of our authors, that at the beginning of this century the obliquity was 23° 27′ 54·78″, and that it shall be, by the end of this century, 23° 27′ 9·08″. That gives, for the nineteenth century, 45·70." Now supposing the motion to be regular and uniform, the earth will complete her revolution, and, say, her glacial epoch revolution, in a period of about 2,832,700 years. Therefore, we have four glacial epochs in less time than three millions of years. Five hundred and twenty-three thousand three hundred years ago, the poles of the earth lay in the plane of the ecliptic. Then each pole, during its winter, would be subjected to intense cold and darkness for more than three months, and in summer to thirty days (720 hours) of almost perpendicular sunshine. During such epochs as that, tropical vegetation would grow right at the poles, and animals, accordingly,would feed and dwell there. Broad and thick sheets of ice would accumulate annually, and cover nearly a whole hemisphere at a time, although but thin around their edges. And the speedy thawing of them would cause great floodings and carryings of *débris* from certain localities to other parts. But now to the coming epoch.

In about 184,800 years from now, the equator of the earth will again lie in the plane of the ecliptic. That will be the middle of one of the greatest glacial epochs which come to our earth. It comes on and goes off gradually, of course, and therefore it will begin some fifty or sixty thousand years before that, and be gone in another fifty or sixty thousand years.

Then will be the time when the vast circular fields of ice grow in thickness to perhaps several miles, especially at and near the poles. Think of ice accumulating for perhaps 100,000 years, and conceive of its thickness. Think of the attractive force of the sun drawing such huge fields outwardly toward the equator, and causing them to move with an eastward tendency all the time; and see how it becomes possible for the ice mass to tear the crest off one mountain and set it down on the top of another lying in its path. It was, doubtless, during the latest one of the kind (that is, something near 1,231,000 years ago) that the crest of a certain mountain was placed on the top of another. I forget their names just now, but the fact is well known to geologists.

These are the periods which, as it were, turn animal and vegetable creation upside down. The gradual change of inclination of the earth to the sun causes all her climatic changes; and thus creatures and vegetation, foreign to certain localities now, will be found in others than they are now in, in the far future, as has been the case many times in the past; for the earth has seen several glacial cycles, and her animal and vegetable genera may truly be called wandering, restless, and ever shifting things,for neither, individually, has any permanent abiding place on the earth. No, not any one thing!

I humbly recommend the above theory to geologists and other scientists,men whose practical knowledge and superior talent can show the facts up to better advantage than I can do.

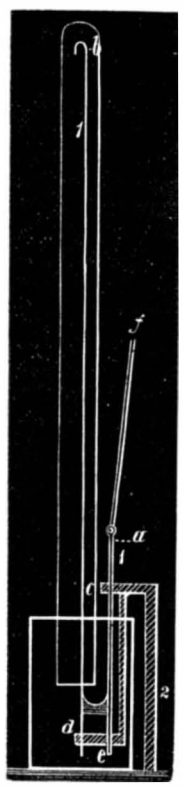
JOHN HEPBURN.

Gloucester City, N. J.

New Registering Barometer.

To the Editor of the Scientific American:

I send you a sketch of a registering barometer, which differs from the ordinary barometer in having a longer tube. The cistern is below the end of the tube a distance equal to the greatest difference of the barometer, with sufficient clearance for the mechanical part immersed in the mercury. From the open end of the tube projects upward a small insulated wire, preferably of tempered steel, terminating in a platinum point. This point is amalgamated, and is hook-shaped, the end being bent down so that it is the lowest uninsulated part. This wire is represented at 1 in the engraving; the wire and all of its connections are insulated from *a* to *b*. At 2 is a standard, to guide the working parts. The bearings, *c*, *d*, and *e*, are in holes drilled in the standard; and the sliding parts should be covered by small iron tubes, slipped on over the insulating substance and fastened with shellac or its equivalent. The standard should be made of iron. For working the instrument, I use an ordinary striking clock, and I deepen all the teeth of the count wheel so that the count hook will drop and stop after one stroke. Above this, there is in the train a wheel which makes one revolution to each stroke; and on the end of the arbor of of this wheel is a crank, which will stand with the crank pin up, when at rest. This crank should have throw sufficient to cover all of the variation, from high to low, and a little over. The fly should be of large size, to give a very slow motion to the crank, to prevent producing waves and fluctuations in the mercury; and for the same reason the tube should be large enough, and the insulation should be as smooth as possible In connection with the crank motion there should be a pair of feed rolls, carrying a paper ribbon for the record. There should be a ratchet motion to bring the paper to a new place for each record. I use chemical telegraph paper for the record, as it requires a smaller battery, not liable to produce sparks to turn the connections, one or two small cells of the gravity battery being sufficient. The connection to the crank is made with the rod at *f*; the top of the wire, 1, is adjusted so that, when at rest, the end of the wire inside of the tube, at *b*, will always be above the highest point that the mercury reaches. Connection with the battery is made by putting one pole in communication with the mercury in the cup, and the other with a plate which the paper passes over, and lies upon. The record can be taken hourly, half-hourly, or at as short periods as 5 minutes. If it be desired to take it once an hour, the hand arrives at the hour and, instead of striking, the wire inside of the tube begins to descend; when the platinum tip touches the mercury, electric communication is made through the mercury in the cistern to the top of the tube, thence through the steel wire down the tube and outside to the clock movement. This crank movement carries an iron wire, which moves down, pin-like, over the paper; at the instant that the platinum tip touches the mercury, the current passes through the paper and produces a blue mark to the bottom of the stroke; when, or just before, it begins to rise, the iron pen lifts from the paper, to prevent tracing both ways or tearing the paper, also to secure greater accuracy: as the mercury, wetting the platinum point, will lift above the actual level by capillary attraction, and will keep the connection too long, and so will spoil the accuracy of the record.



I put in connection with the iron pen a thermostat, which raises or lowers the pen, making allowance for the expansion of the mercury by heat, so that a thermometrical record could be kept at the same time and on the same paper. On the paper I place points of copper in connection with the battery, and these make lines at right angles with those of the barometer record, which will be perpendicular. These copper points are placed to indicate inches or their fractions. They are adjustable to the exact point, and then are set by screws. They are all in electric communication, but the conductor to them has a greater resistance than the iron pen, to prevent their taking too much force from it. The paper going between the copper points is lined lengthwise in red, and these lines are crossed by blue lines, of greater or less length, according to the state of the barometer, all ending alike at the bottom, each line representing the period of time which the clock registers. I can dispense with all but one of the copper points; and if this represents the 30 inch point, I can measure from this. It is, however, but little trouble to graduate to very small divisions, if necessary. The copper points I make by soldering thin pieces of copper, with the edges toward the paper, to pieces of steel wire. I place two of them very close together for the whole inches, the fine white line between being the inch line.

The advantages I claim for this barometer are cheapness in making and running. There is no work for the mercury to do whatever, as the mechanical part is all done by the clock; and it will do the most accurate work possible, if it is made nicely. I should be pleased to hear, from any one who tries this plan, as to its success.

WM. A. BARNES.

Bridgeport, Conn.

THE MOON.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY BY PROFESSOR C. A. YOUNG, OF DARTMOUTH COLLEGE.

If this were a literary instead of a scientific lecture, it could not be more appropriately introduced than by quoting some of the beautiful lines which the poets of all ages have lavished upon the moon, the empress of the night. The moon was perhaps the first of the heavenly bodies that was regularly observed. The ancient observations of eclipses form the basis of many determinations in the chronology of the earth's history. To the mariner at sea, its regular passage across the heavens has always been a means of knowing the time. The modern astronomer is able, without leaving the observatory, to determine the earth's size more accurately by studying the moon than he could by traveling all over the surface. To a person observing the path of the moon from any point of the earth's surface, it will appear less than a semicircle by an amount proportional to the radius of the earth at that point. If the moon could be observed from the center of the earth, we assume, for the sake of simplicity of illustration, that its path would appear a complete semicircle. Hence we have the means of determining the radius of the earth. Even the density of the earth could be determined by a careful observation of the moon's influence upon the tides.

The most convenient way of determining the distance of the moon from the earth is from two distant stations, whose positions on the earth's surface have been accurately ascertained. One of these stations is usually at the Cape of Good Hope, and the other either at Greenwich, Paris, or Berlin, etc. The distance between the two stations, measured on the same meridian, forms the base line, and the observed direction of the moon, when it crosses the meridian, will give us the angles at the base, from which the distance can be calculated. This distance is, in round numbers, 238,000 miles, or about ten times the circumference of the earth. A good pedestrian could travel that distance in 23 or 24 years. The determinations of the moon's distance are so accurate that the probable error does not exceed 15 or 20 miles. This distance is not, however, constant, because the moon's path is not a circle but an oval, the eccentricity of which amounts to about $\frac{1}{18}$.

The size of the moon's diameter is determined by measuring its apparent diameter in the telescope, the difficulty of the operation consisting in the fact that the brightness of the disk causes it to present a circumference which is not defined with perfect sharpness. Having measured the apparent diameter of the moon, and knowing the value of the earth's diameter, as seen from the moon, a simple proportion will give us the moon's real diameter, 2159·6 miles, or about the $\frac{1}{120}$ part of the distance between the earth and the moon, that is to say, 120 moons placed in a line would fill up the distance. The determinations of the value of the moon's diameter are correct to within two or three miles. Then, as the volumes of spheres are to each other as the cubes of their diameters, the volume of the moon is $7930^3 \div 2160^3$, or about $\frac{1}{49}$ that of the earth, that is, 49 moons rolled up together would make a ball as large as the earth. The determination of the density, and consequently of the weight, of the moon is more difficult than that of the most remote of the planets. One method of accomplishing it consists in studying the effect on the tides when the attractions of the sun and moon conspire to raise them, and when they act in opposite directions. In this way a relation is established between the masses of the sun and moon. If the sun and moon were at equal distances from the earth, their attractions would be in direct proportion to their masses, but the sun is about 400 times further off; hence the law that the attraction is inversely as the square of the distance must be also applied This method, however, is not very accurate. A better one depends on the fact that the earth and the moon revolve about their common center of gravity, and that the position of that center must necessarily depend on the relative masses of the

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two bodies. The earth describes a much smaller orbit about that center than the moon, and would be displaced from the position which it would have if it traveled alone around the sun. This displacement will appear in the observed position of the sun, and can be calculated. It has been found to be 6½ seconds of arc; and from this it results that the earth's mass is 81½ times that of the moon. Hence the moon's density is ⅝ that of the earth.

The force of gravity on the moon is only ⅙ of that on the earth, that is, a man able to jump up 3 feet on the earth would be able to jump up 18 feet on the moon's surface.

Fig. 1.—THE CRATER OF PLATO.

The moon's path around the earth would always be an oval of exactly the same dimensions if the earth alone acted upon it; but owing to the attraction of the sun, the moon is sometimes in advance and sometimes behind the place she

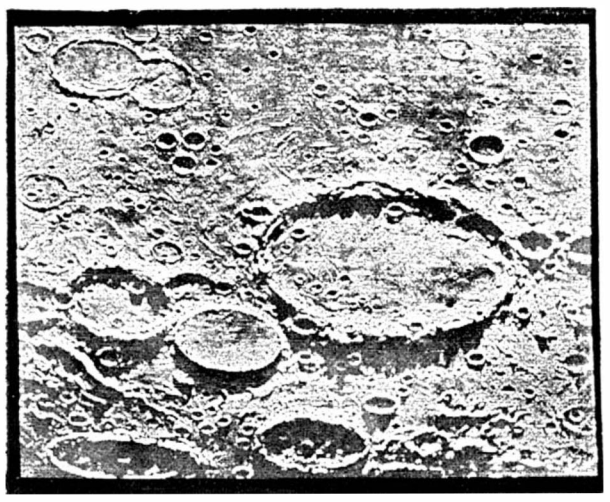
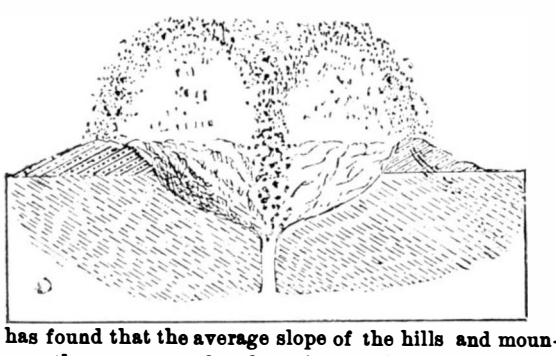


Fig. 2.—THE CRATER WARGENTIN.

ought to occupy according to the laws governing motion in an elliptical orbit. These attractions are called perturbations and necessitate as many as 60 to 75 different corrections in calculating the position which the moon is to occupy at any required moment. Up to about 1870, the calculated position of the moon was only about two miles out of the way; but since that time, some error has crept into the nautical almanac, and the difference is now 5 to 7 miles. Professor Airy thinks some perturbation must have been overlooked. If a mariner had a watch that kept perfectly Greenwich time, he could always ascertain his position by consulting the nautical almanac. The moon is indeed a perfect timekeeper in its passage across the heavens; but its motion is so slow that it would take very accurate observations to obtain the time from its position.

According to Zöllner, the light of the moon is only $\frac{1}{618000}$ of that of the sun. If the sky were packed full of moons, it would not give us quite as much light as the sun. It has been found that, when the moon is half full, it does not give half as much light as when it is full, because the mountains then cast shadows, while there are no shadows at all on the full moon. From a study of these shadows, Zöllner has found that the average slope of the hills and mountains on the moon must be about 52°, without reference to their hight.

Fig. 4.



Zöllner has ascertained, by experiment and calculation, that the moon reflects only about ⅛ of the light it receives, in other words that its reflective capacity is the same as that of sandstone rock. Snow reflects 78 per cent, granite 10 per cent, and marble 50 per cent. Sir John Herschel had come to the same conclusion. "I have frequently," he stated, "compared the moon setting behind the gray perpendicular façade of the Table Mountains illuminated by the sun just risen in the opposite quarter of the horizon, when it has been scarcely distinguishable in brightness from the rock in contact with it."

Until quite recently, it was supposed that no heat could be detected in the rays of the moon. They were collected in the focus of a large mirror, and directed upon a very delicate thermopile connected with a galvanometer. The lecturer had this apparatus upon the table, and showed the effect of the heat of a candle placed at a distance. It was discovered by Melloni that the feeble heat coming from the moon was rendered insensible by the earth's atmosphere, and Professor Smyth, on repeating the experiment on the summit of Teneriffe, about 10,000 feet above the level of the sea, discovered that the heat of the full moon was equal to ¼ that of a candle placed at a distance of 15 feet from the apparatus. The moon is hottest between the last quarter and the new moon, because it has then been exposed continually to the sun for 14 days. Its temperature must then be from 400° to 500°; again, during the long night, 14 days long, it must cool down to something like 100° to 200° below zero.

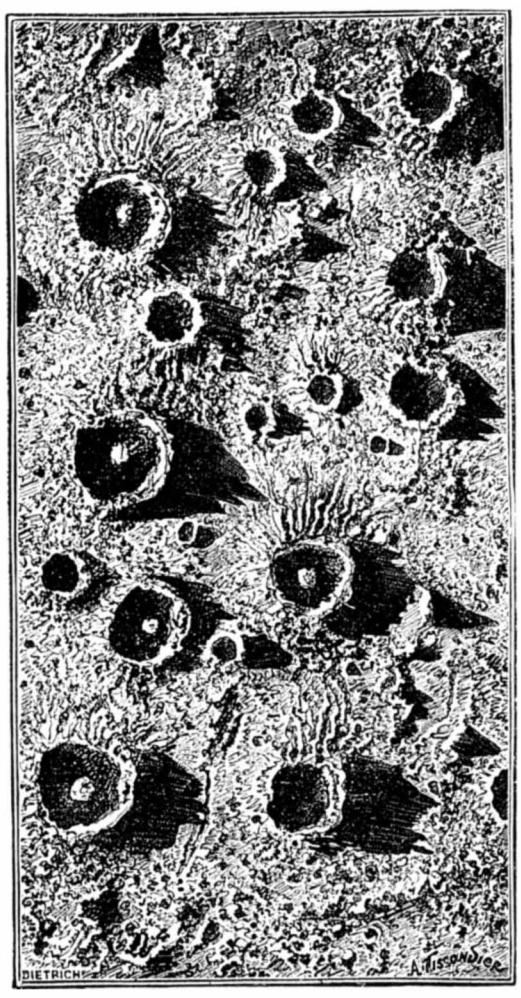
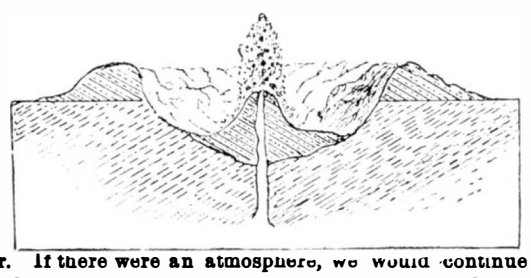


Fig. 3.—SURFACE OF THE MOON.

No atmosphere exists on the moon, as is proved by the absence of refraction, when the moon passes between us and a star. If there were an atmosphere, we would continue to see the star some time after its disappearance behind the disk of the moon; but this is not the case. The star is instantly extinguished. The observations on this point are so accurate that a refraction of 4 seconds of arc could be easily detected. If therefore, there be an atmosphere at all, it must be more rare than that under the receiver of an air pump after we have exhausted all the air we can.

Fig. 5.



The moon always turns the same face towards the earth, and we only obtain glimpses of the edges of the opposite hemisphere, on account of the irregularities of its motions called librations. Hence we conclude that it turns once around its axis while it performs one revolution about the earth; otherwise we should see the whole of its surface.

If the moon ever had an atmosphere, as is very likely, it may have been absorbed, or it may have entered into combination with the rocks on its surface; but this is mere conjecture. As there is no atmosphere, there is also no moisture, and hence the moon cannot be the abode of beings constituted as we are.

It has been stated that the powerful telescopes of modern times bring the moon down to within 40 miles of us; but that is not sufficient for distinguishing any of the works of inhabitants, if there be any. A city would appear as a mere dot.

The surface of the moon has been carefully studied with the telescope and by means of photography. The first successes by the latter method were obtained by Dr. J. W. Draper, of New York, in 1840, and Rutherfurd's excellent results are well known. The lecturer then threw upon the screen a large number of photographic representations of the moon's surface, showing the principal mountains, craters, valleys, and other points of interest. Some of these mountains have a hight of 18,000 feet.

Fig. 1 represents the crater of Plato, the bottom of which has been observed to grow darker as the sun rises higher above it, which is by some supposed to be due to its being covered with some sort of vegetation. Notice also the ravine below, looking like a deep railroad cut. Fig. 2 is a view of the crater Wargentin, which presents the peculiarity of being entirely filled up, while the other lunar craters resemble that of Kilauea on one of the Sandwich Islands, a great basin about 1,000 feet deep, out of which numerous cones rise.

Fig. 3 is a representation of a comparison of craters on the moon with the appearance of the volcano Vesuvius and the country in the vicinity of Naples. Both were studied topographically and modeled in plaster of Paris, with the most scrupulous care, by Nasmyth, and the accompanying engraving was made from a photograph of his models.

The only difference between the lunar craters and that of Kilauea is that the former are of enormous dimensions. Copernicus, for example, is 56 miles in diameter; its central mountain is 2,400 feet high, and the terraces around it rise to a hight of 12,000 or 13,000 feet above the bottom, and are composed of ridges, cliffs, and deep ravines.

VESUVIUS AND ADJACENT COUNTRY, ITALY.

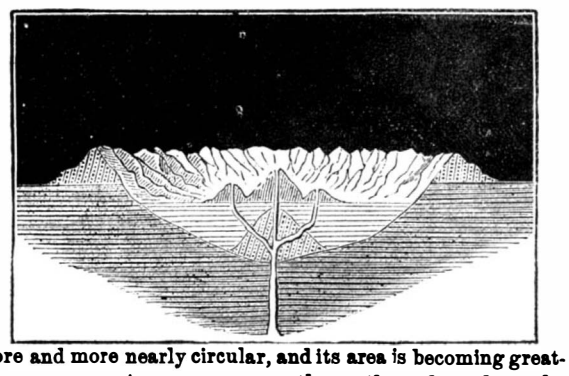
Figs. 4, 5, and 6 illustrate Nasmyth's theory of the formation of these craters. The first eruption, being probably the most violent, projected the stones, lava, etc., to a considerable hight, and these, in falling, would accumulate in ridges encircling the crater at some distance. The hight to which they would rise would be much greater than on the earth, because the force of gravity is much less.

During the second eruption, which would probably be less violent, the projected matter would not rise so high, and in falling back it would cause the formation of the central cone.

During the subsequent eruption, when the force of the volcano was almost entirely spent, the lava would simply overflow and tend to fill up the basin to a greater or less extent.

There is a gradual change going on in the orbit of the moon, which deserves to be noticed. The ellipticity of the earth's orbit is slowly diminishing; so that it is becoming more and more nearly circular, and its area is becoming greater every year. As a consequence the earth tends to draw the moon nearer and nearer to itself, and causes it to describe a constantly diminishing orbit. The end of this might be to pull the moon down upon the earth. The change is, however, so exceedingly small that we need not entertain any apprehensions for our posterity for many years. C. F. K.

Fig. 6.



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IMPROVED RAILWAY SWITCH SIGNAL.

The invention herewith illustrated is a new apparatus for moving switches, which is so constructed that it is impossible to move the lever without the latter turning the colored light or flag so as to indicate the position of the switch to approaching trains. This is effected by mechanism which causes the lever to turn one quarter of a revolution whenever it is altered, and thereby to rotate the lantern or flag attached to its upper portion.

The lever, as shown in Fig. 1, is made in two parts, the lower one of which is attached below to the rod leading to the switch, and above is forked. The upper part of the lever is pivoted at the fork of the lower part, as shown in Fig. 2, and is supported by a cap at A. Said upper portion carries the red and white lantern and flag as shown, so that, when rotated one quarter revolution on its vertical axis, the change may be made from white to red signal, or *vice versâ*. Formed on the lever is a rounded lug, B, Fig. 2, which, when the lever is perpendicular, enters a curved recess, C, Fig. 1, in the upper edge of the top bar of the switch stand. It will be obvious that, when the lever is moved in either direction, the lug, in leaving the recess, will cause the lever shaft to make a quarter revolution. On the under side of the upper bar of the switch stand, and just beneath the recess, C, is a lug, D. Also on the lever shaft are ears, E. When the lever is moved from an inclined to a vertical position, the ears, E, strike against the lug, D, and turn the lever so that the lug, B, is caused to enter the recess, C. It will be clear also that, when the lever is thrown completely over from end to end of its frame, by the means already described, it will be turned half a revolution.

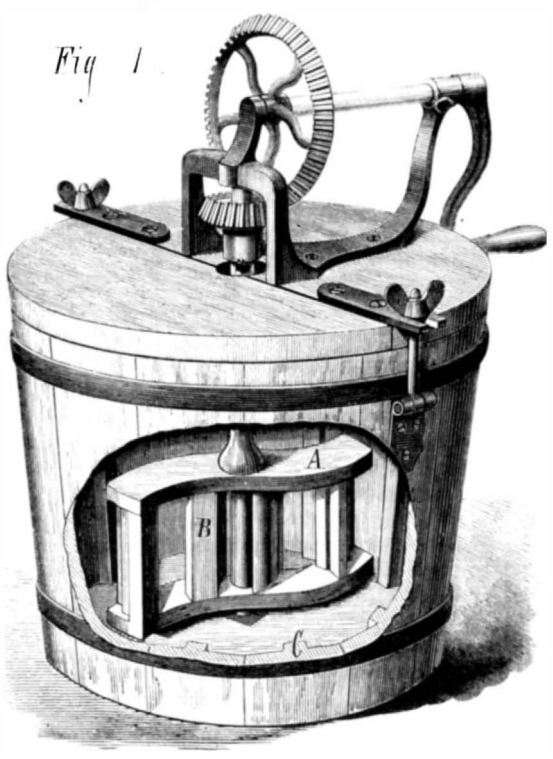
By this mode of operating the switch, the last displacement, even to one third of an inch, is indicated by the signals being turned, so that it is practically impossible for the switch tender to set the switch wrong without the same being clearly shown. There are no extra movements beyond those ordinarily required, namely, to unlock, throw back, and lock the lever. Patented through the Scientific American Patent Agency. For further particulars relative to rights to manufacture, etc., address the inventor, Mr. Charles W. Spayd, Box 620, Wilkesbarre, Pa.

Hard Paper.

French manufacturers have a method of rendering paper extremely hard and tenacious by subjecting the pulp to the action of chloride of zinc. After it has been treated with the chloride, it is submitted to a strong pressure, thereafter becoming as hard as wood and as tough as leather. The hardness varies according to the strength of the metallic solution. The material thus produced can be easily colored. It may be employed in covering floors with advantage, and may be made to replace leather in the manufacture of coarse shoes; it is also a good material for whip handles, the mounting of saws, buttons, combs, etc. A great deal is used in large sheets for roofing. Paper already manufactured acquires the same consistence when plunged, unsized, in a solution of the chloride.

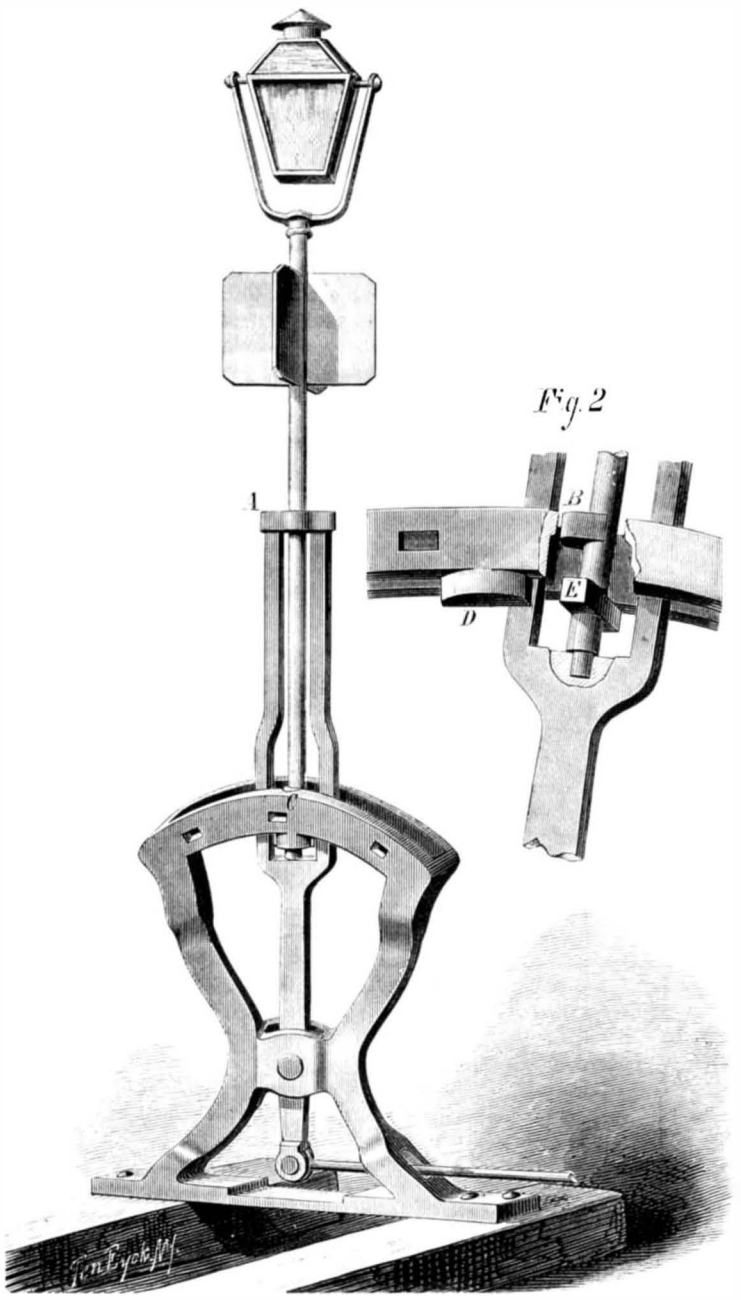
SHEPHARD'S IMPROVED CHURN.

We illustrate herewith a churn of novel construction patented through the Scientific American Patent Agency, March 28, 1876, by Mr. E. W. Shephard, of Wilmington, Ohio. The arrangement of parts is such that the cream is thrown



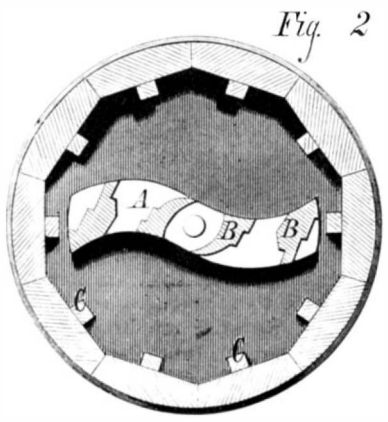
into violent agitation, while swift currents are set up and instantly broken, so that the butter is brought, it is claimed, with great rapidity.

The body of the churn is formed of ten staves, flat on their inner sides, as shown in the section, Fig. 1, so as to produce a number of interior angles. In the bottom of the vessel is an antifriction socket to receive the dasher shaft, to the lower part of which shaft are attached the S-shaped crossbars, A, Fig. 1. Between said bars are secured four upright paddles, B, placed with their forward edges inclined inward, and rabbeted or concaved on the sides, as shown in section in Fig. 1.



SPAYD'S RAILWAY SWITCH SIGNAL.

By means of the simple arrangement of crank and bevel gearing shown above the churn, the dasher is swiftly rotated, and the currents produced in the cream are broken by the angles in the churn body, and also by the ribs, C, arranged around the interior. The mode of securing one half of the



churn cover is plainly exhibited in the engraving; the other half is loose, so that it can be taken off to allow of the inspection of the progress of the churning.

For further information, the inventor may be addressed as above.

Bleaching Shellac.

Lemming's method for the purification or bleaching of shellac consists in either boiling with, or filtering the hot alcoholic solution through, well burnt and recently heated animal charcoal. When necessary, this operation is repeated until the solution is colorless, when it is filtered through fine silk, and finally through fine filter paper. To insure success, the solution should be in the proportion of about five ounces of shellac to one quart of alcohol (rectified spirits of wine). Dr. Hare published a method for bleaching the lac by means of chlorine. He dissolved one part of shell or seed lac in a boiling solution of one part of pearlash in about eight parts of water. The solution was then cooled and impregnated with chlorine gas till the lac was all precipitated. The precipitate thus obtained is white, but the color deepens by washing and consolidation; dissolved in alcohol, lac bleached by this process yields a varnish which is as free from color as any copal varnish. The application of chlorine must be made by a person acquainted with chemistry. Hence chloride of lime is safer as a bleaching agent, the lime being afterward dissolved out from the precipitate by dilute muriatic acid.

Atmospheric Ammonia.

M. Schloesing has recently studied the exchange of ammonia which takes place between water and the atmosphere. The water which condenses in the clouds and which falls in rain would at first sight appear to despoil the air of all the ammonia contained. Such, however, is far from being the case. Sixteen analyses conducted at different temperatures show that the water never dissolves all the atmospheric ammonia. At 77° Fah., the water takes up but 3 per cent of the total amount of ammonia in the air; at 68°, 4 per cent; at 59°, 6 per cent; at 50°, 11 per cent, and finally, at 41°, 19 per cent. From this it appears that, the lower the temperature, the greater is the amount of ammonia dissolved.

THE BENTON PATENT COPPER FLOAT.

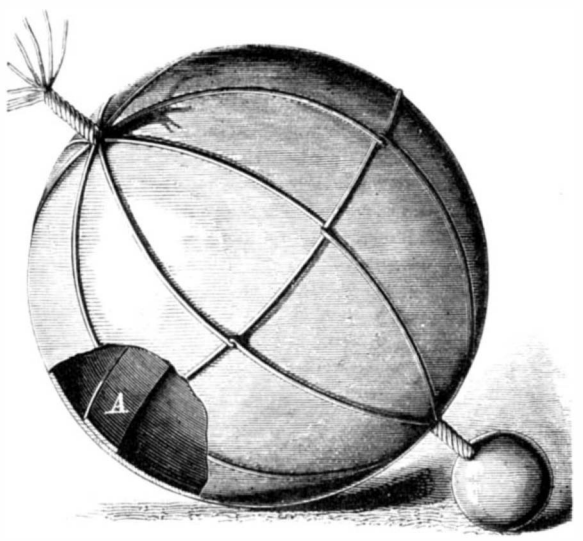
In the annexed engraving is represented a copper float, such as is used in steam boilers, etc., made by a new process. The manufacturers claim that the float is the only one yet invented which will stand the action of steam in a boiler for any length of time, without leaking and becoming filled with water, and consequently useless. The device, it appears from actual test, is extremely strong, and is altogether indifferent to the effects of sudden and wide changes of temperature.

Two hollow hemispheres are spun out of sheet copper of suitable thickness. These are connected at their circumference by being slipped upon a circular ring, A, that is slightly beveled at the edges, to correspond with the curvature of the hemispheres. The latter are also beveled so as to bind intimately on the ring when they are driven thereon.

The float is next suspended in a galvanic copper solution, and a perfect joint is made by the filling up, with copper, of the beveled edges of the hemispheres. The float is then removed, and such of the solution as has entered the interior is blown out through two small holes, bored for the purpose. These holes are then plugged and the plugs, covered with a thin film of copper, by again placing the globe in the solution. A second layer may also be deposited over the joint to secure the strong and perfect connection of the parts.

The test to which these floats are subjected are very severe. They are first placed in a steam-tight tank, into which steam is admitted until they are highly heated, the water of condensation being constantly drawn off. The steam valve is then shut, and cold water is suddenly admitted until the tank is about three fourths filled. The lower half of each float under test is thus suddenly covered, while the upper half remains hot. Under these conditions, we are informed, no sighs of separation at the joint, through contraction or expansion of the metal, appear. The floats are also tested with a cold water pressure of 400 lbs. to the square inch. The manufacturers state that they have experimented with the joint by beating out the copper until it was as thin as tissue paper; and that they will guarantee it to stand until the copper itself is eaten away. Our engraving shows a mode of slinging the float in copper wire, to which a brass is attached to keep the device in proper position.

Patented through the Scientific American Patent Agency, February 1, 1876. For further information address the



manufacturers, Messrs. Benton, Gore & Co., Milwaukee, Wis.

GREASE can be removed from billiard or other cloths by a paste of fuller's earth and turpentine. This should be rubbed upon the fabric until the turpentine has evaporated and a white powder remains. The latter can be brushed off, and the grease will have disappeared.

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THE CONE-BERRIED SOLANUM.

Among the plants suitable for indoor cultivation, those which bear berries are generally considered to be the most ornamental. Among the solanums, which are very much sought after for this purpose, the subject of our illustration is likely to become a general favorite. There are several varieties of this species in cultivation, which differ from each other in size and in form of the berries; but the conical berry of the *solanum capsicastrum* is somewhat of a novelty. A correspondent of the English *Garden*, from the pages of which we select our engraving, states that a plant of this variety, about 1 foot high and 1 foot in diameter, was recently seen profusely covered with these berries, which are, when mature, of a bright orange color. It is one of a batch raised from seed sown in March. The seedlings were potted out; and about the last week in May, they were planted out on a western border. Here they received no attention, except occasional waterings until the autumn, when, just before the berries commenced to color, they were carefully lifted, and potted in 32-sized pots. They soon formed new roots, having been kept in a close atmosphere for a few days after lifting; and at Christmas, the plant, from a portion of which the accompanying illustration was prepared, was loaded with berries, handsome both in shape and color. We have no doubt that this variety, when better known, will be generally cultivated.

SOLANUM CAPSICASTRUM.

TWO BEAUTIFUL YUCCAS.

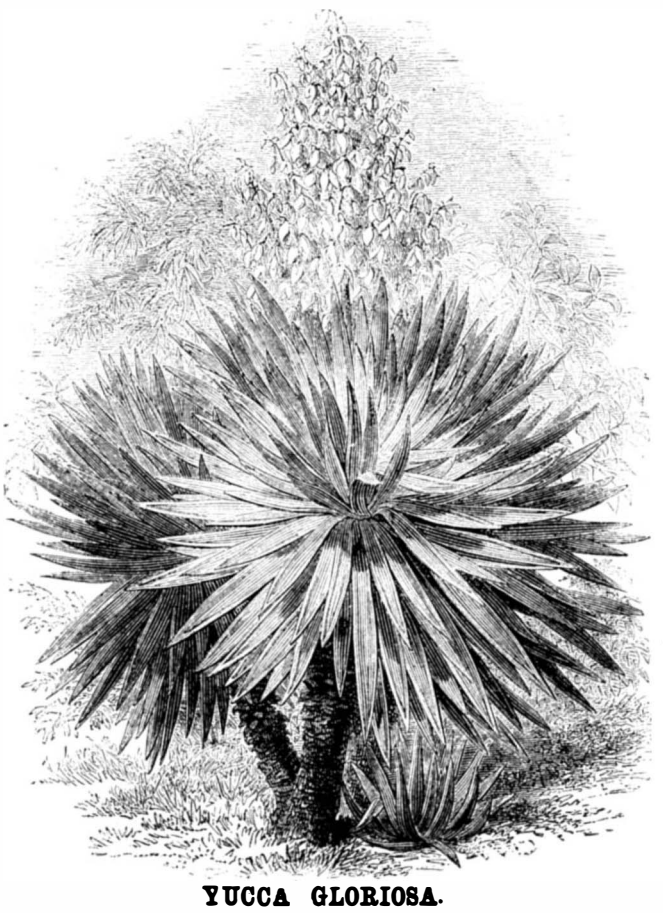
The yucca family of shrubs are all, we believe, indigenous to this country; and they are now being much cultivated in Europe, and are highly valued for the boldness and vigorous growth of their foliage, and their ornamental appearance when in blossom. There are many varieties of them, some of which we have heretofore illustrated; but we believe that the two specimens here presented are little known to the general public.

The *yucca Treculeana* was first brought from Texas in 1850, and is much cultivated in France, whither it was first imported by Mr. Trecul, after whom it is named. It forms a very stout stem, and the fully developed leaves are from

YUCCA TRECULEANA.

3 to 4½ feet long by 2 to 2½ inches broad, dark green on both sides, with a hard, sharp point, and very fine regular teeth. The inflorescence of this species is an exceedingly dense, many branched panicle, not much overtopping the nearly erect upper leaves. A warm sheltered situation should be selected for it. It will be seen that this plant is one of the most remarkable of its kind as regards general appearance and the size to which its leaves attain. The flower stem, which rises up to a hight of 3 feet or more, consists of a mass of branchlets about 18 inches in length, bearing multitudes of cream-colored flowers, shining as if glazed.

Our second specimen is the *yucca gloriosa* of Linnæus; and it has well been styled the most majestic and beautiful of the genus. It has been known in Europe since the end of the sixteenth century; and it was, when first found on our coast (from Florida to North Carolina), about 2 feet or rather more in hight. It is now, however, by no means uncommon to see these plants reach as high as 10 or 15 feet, in favorable situations; sometimes, indeed, it stands when in blossom as high as 20 feet, the blossom with its stalk attaining 6 feet. This species flowers freely in sunny situations, after it has reached a certain age; but plants from suckers are usually some years before they flower. The trunk branches after flowering, and it is not unusual to see old specimens many times branched, forming very heavy heads, which should be supported. It is very variable, though, perhaps, not more so than the other species of the genus, but its varieties are better known. The ordinary form or type has upwards of 100 leaves in a dense tuft, 24 to 30 inches long, and 3 inches broad at the middle, narrowed in luxuriant specimens gradually upwards to a brown sharp point, and downwards to 1¼ to 1½ inches above the base; it is green or slightly glaucous when young, very rigid, even the outer older ones remaining erect; face, concave, with longitudinal folds; margin, entire, with a distinct brown line; panicle, 3 to 6 feet long, according to the vigor of the plant, not downy or hairy; flowers, large, among the handsomest of the genus, almost globular or goblet-shaped, when the petals are incurved; petals, oblong, narrowed into a point at the top, from 2½ to 3 inches deep, the inner ones from 1 to 1½ inches broad, the outer ones narrower, and distinctly banded, or more or less tinged, with bright red down the back; or sometimes the flowers are almost a pure white, seedlings varying much in this respect.



YUCCA GLORIOSA.

Chinese Method of Welding.

The *Ironmonger* says that Mr. Balestier, who went on a mission to the East, describes the Chinese method of welding cracked ironwares by cementing them with cast iron while in a liquid state. In a cast iron pan, which Mr. B. required to be welded, the operator commenced by breaking the edges of the fracture slightly with a hammer, so as to enlarge the fissures, after which the fractured parts were placed, and held in their natural positions by means of wooden braces. The pan being ready, crucibles, made of clay, were laid in charcoal and ignited in a small portable sheet iron furnace, with bellows working horizontally. As soon as the pieces of cast iron with which the crucibles were charged were fixed, it was poured on a layer of partly charred husks of rough rice, or paddy, previously spread on a thickly doubled cloth, the object of which is to prevent the sudden cooling and hardening of the liquid metal. While in the liquid state, it is quickly conveyed to the fractured part under the vessel, and forced up with a jerk into the enlarged fissures, while a paper rubber was passed over the obtruding liquid inside of the vessel, making a strong, substantial, and neat operation.

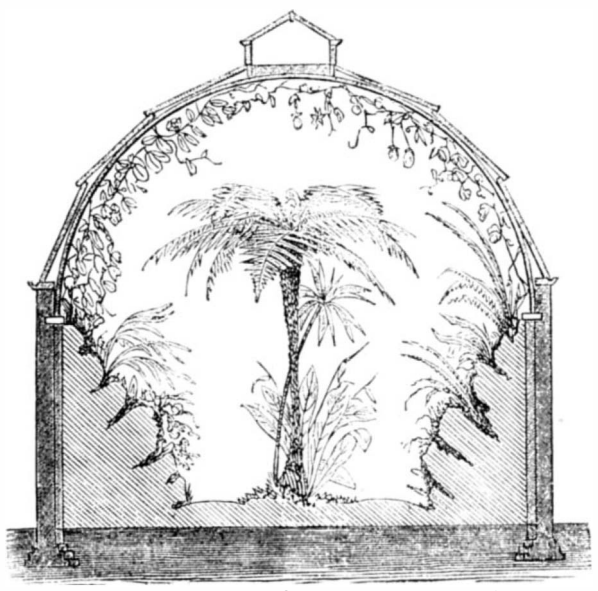
Two Bee Questions Answered.

A couple of vexed questions about bees were recently answered by Professor C. V. Riley, at a bee keepers' council in St. Louis. The first query was: Do bees make or gather honey? The Professor says they make it. Thus does Science proclaim that the venerable Dr. Watts was wrong when he asserted that the busy bee "gathers honey all the day from every opening flower." The nectar lying in flowers never would become honey, says Professor Riley, no matter how manipulated by the hands and minds of men; but it is taken up by the bees and passed through a state of semi-digestion and excretion, resulting in the manufacture of what is called honey, yet still retaining in part the flavor or perfume of the flowers, by which we determine one kind of honey from another. Professor Riley's views were corroborated by a paper read by a botanist and chemist of Louisana, describing the process of change undergone by nectar in the stomach of the bee, in order to become honey.

The second question is an interesting one to fruit raisers, as it involves the mooted point of whether bees do or do not injure fruit. Professor Riley, on being appealed to, produced an illustration of the order of hymenoptera, stating that the mouth of the bee is the most complicated structure in insect anatomy. Its construction however, is the same as that of the wasp, and no one denies that the wasp is capable of destroying fruit. The Professor thought beekeepers were prejudiced against the idea of such power in the possession of a bee, but it is true. Still, while being capable of injuring fruit, the bees rarely do so except in seasons of severe drought and when urged by necessity. This fact is no derogation to the usefulness of the insect, for the exercise of its power as a pollenizer is of undoubted value to the orchardist, even with all its depredations upon fruit.

A NEW FORM OF FERNERY.

We publish herewith an engraving showing a cross section of a new form of fern house, recently erected in Scotland by Messrs. Boyd, of Paisley. The arrangement is so well shown in the illustration that but little description is necessary. The building here shown is of large size, 30 feet high in the center, and 60 feet long; but the plan can of course be adapted to circumstances. In this case strong brick walls are carried up both sides and at one end, from which the rockwork slopes irregularly down on either side, forming a miniature ravine with a water all,



the stream meandering round the crags and among the stately tree ferns. The building is covered by a glass roof, supported by strong iron girders, and the interior is left without a single pillar or tie rod, leaving the space wholly to the ferns and rockwork.

Useful Recipes for the Shop, the Household, and the Farm.

A correspondent of the *Ohio Farmer* gives the following method of making a simple corn marker: Take a plank 7 feet long, 16 inches wide, and 1½ inches thick. Pin this on three blocks, 5 by 8 inches thick and 16 inches long, putting one block at each end and one in the middle. With this length the marker is easily turned at the ends. For a tongue, get a smooth tough pole, and fasten it to the center of the plank in such a way that, when the team is hitched up, the marker will stand level. Now take a lath, 1 by 2 inches thick and 10½ feet long. Drive a staple into the plank at each end of the marker and one in the middle. Pass the lath through one outside staple and the end just through the center staple. Fasten a chain to the outer end, and the marker is completed. The chain marks where the middle block or marker must follow the next time across. The lath must be shifted at each end so as to keep the chain on the unmarked land. When using it, stand on the middle of the plank and keep the tongue directly over the chain mark. If the first mark was made straight, all the rest will be so, and equally distant apart. If desired, the lath may be fastened to the middle of the plank with a bolt, so that it can be turned from side to side without lifting. Secure it in position by another bolt, passed through the lath and plank, near the ends of the latter.

It has recently been found by experiment at Cornell University that, as farmers generally know, by sprouting garden seeds before sowing there is a gain of three or four days in the time of ripening.

For plating iron, steel, brass, lead, and zinc with tin, the following has recently been proposed. Prepare a solution of perchloride of tin by passing chlorine through a concentrated solution of salt of tin. Dilute the pro

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duct with 8 or 10 times its volume of water, and filter if necessary. The article, half scoured with sulphuric acid, is to be polished with sand and the scratch brush, then washed with water, and hung by a zinc wire for 10 or 15 minutes in the perchloride of tin solution. Afterwards take it out, rub it with the scratch brush, dry it, and polish it.

If brooms are wet with boiling suds once a week, they will become very tough, will not cut a carpet, and will last much longer. A handful or so of salt sprinkled on a carpet will carry the dust along with it and make the carpet look bright and clean. A very dusty carpet may be cleaned by dipping the broom in cold water, shaking off all the drops, and sweeping a yard or so at a time. Wash the broom and repeat until the entire carpet has been swept.

The following compound is said greatly to facilitate the washing of clothes. Dissolve 2 lbs. of bar soap in about 3 gallons of water as hot as the hand can bear. Add 1 tablespoonful of turpentine, and 3 of liquid ammonia. Stir, and steep the clothes in this for three hours, keeping the vessel tightly covered. Then wash the clothes in the usual way. The soap and water may be used a second time, in which case a teaspoonful of turpentine and the same amount of ammonia must be added. This treatment is calculated to save much labor in cleansing summer clothes stained by fruit, etc.

Very durable and neat mats for floors can be made from old coffee sacks. A piece of the bagging of suitable size is bound with some dark fabric and secured to a frame of four laths. By means of a hook of wood or iron, like an enlarged crochet needle, carpet rags are carried through the material so as to skip every other thread and to leave loops half an inch long, the ends, of course, being fastened. Old red flannel can be used to make tasteful borders.

A new and simple blowpipe consists of two large jars connected near the bottom by a piece of rubber tubing. One is filled with water and put on a shelf above the table on which the other stands. The water passes into the latter, and, in doing so, forces the air out through a stopper and piece of tubing into the blowpipe, which is supported separately. With jars of 1 gallon capacity and a blowpipe with an orifice of 0 016 inch, a steady air current of 10 minutes' duration is obtained; and to keep it up, one has merely to transpose the jars.

A compound of grease and zinc filings is found to be an excellent preventive against rust for iron bolts inserted in wood. It is used to line the bolt hole.

Pulverized anthracite coal, spread on the soil to the depth of half an inch, is said to have a remarkable effect in brightening the colors of flowers of potted plants.

To keep striping pencils in good shape and ready for use, grease them with tallow from a candle and spread the hair straight on a piece of glass; keep them preserved from dust.

A good bronze paint for iron is made of ivory black, 1 oz., chrome yellow, 1 oz., chrome green, 2 lbs. Mix with raw linseed oil, adding a little japan to dry it. This gives a fine bronze green.. If desired, gold bronze may be put on the prominent parts of the object when the paint is not quite dry, the powder being rubbed in with a piece of plush.

A weak solution of cyanide of potassium cleans gold lace well.

To prepare skins for fur, mix bran and soft water sufficient to cover the skins. Immerse the latter and keep them covered for 24 hours; then remove, wash clean, and carefully scrape off all flesh. To 1 gallon of water (hot) add 1 lb. of alum and ¼ lb. of salt. When dissolved and cool enough to admit entrance of the hand, immerse the skins for 24 hours, dry in the shade, and rub. Stir the liquor again, immerse the skins for 24 hours, dry, and rub as before, immerse for 24 hours in oatmeal and warm water, partially dry in the shade, and finally rub until entirely dry. This leaves the skin like whiteleather, and fit for immediate use.

Never dilute varnish with turpentine, as it kills the gloss. If too thick, warm it by the stove or place the cup on a warm iron.

To bend amber, drop it into hot beeswax. After it has been immersed for a few minutes, remove it, and, holding it before the fire, bend it to the desired shape.

AGRICULTURAL MACHINERY.

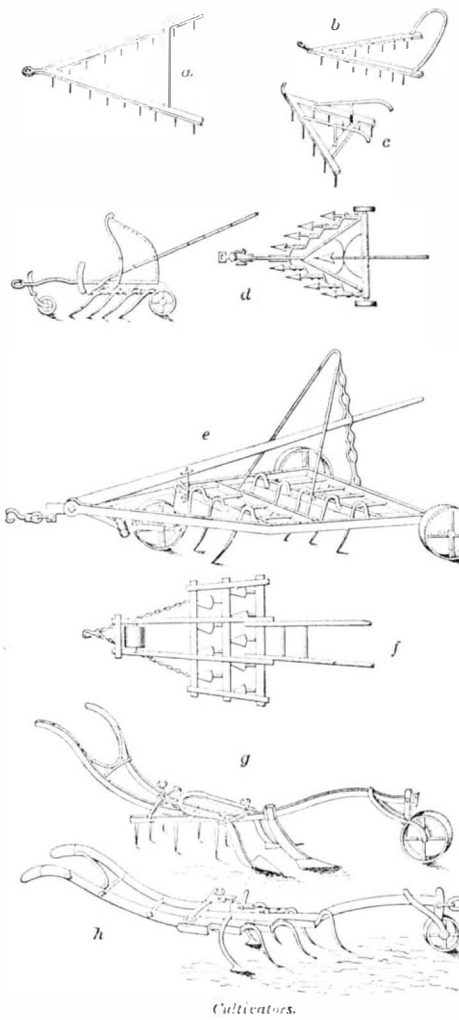
We extract from Knight's "New Mechanical Dictionary,"* this week, a series of engravings of various agricultural implements, which doubtless will prove of timely interest to farmers. In Fig. 1 are represented several forms of

CULTIVATORS,

under which heading may be included harrows, grubbers, drags, shovel plows, and like implements. The A-shaped harrow, *a*, is well adapted for new ground and in fields where there are occasional obstructions. The rear corners may be readily raised by a hooked stick, so as to allow it to pass a stump without swerving the team. Better still is a bow of hickory, as shown at *b*. Another mode of affixing handles is exhibited at *c*. Wilkie, of Teddington, Scotland, was the inventor of the cultivator proper; he devised the plurality of shares, the expanding frame, and the caster wheel. His cultivator is shown at *d*. The share frame is so suspended from the traction frame as to be raised bodily, by a parallel movement, by means of a single lever at the rear. The teeth are prongs curved to enter the soil obliquely. Finlayson's cultivator, *e*, *f*, is made of iron, and the prongs are arranged on parallel transverse bars of the frame, which is supported on a caster wheel in front and two wheels at the rear. The depth of tilth is regulated by a lever, which is connected to the carriage of the caster wheel so as to raise the apex of the frame when the lever is depressed, and conversely. Wilkie's horse hoe and drill harrow, *g*, has a central fixed share and adjustable side shares, which are expanded or contracted according to the state of the crop or the

*Published in numbers by Messrs. Hurd & Houghton, New York city.

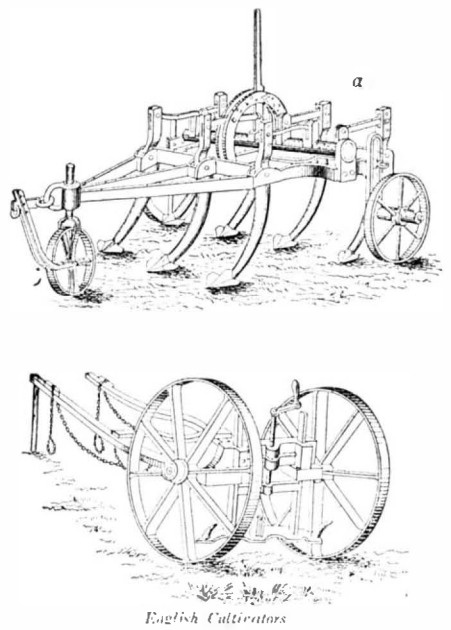
Fig. 1.



Cultivators.

width of the balk. Following the shares is a frame with harrow teeth. Either the share or the harrow teeth may be removed, and the remainder used separately. The depth is adjusted by the caster wheel in front. *h* shows another form, somewhat modified. In Fig. 2, *a* is Colman's cultivator, and

Fig. 2.



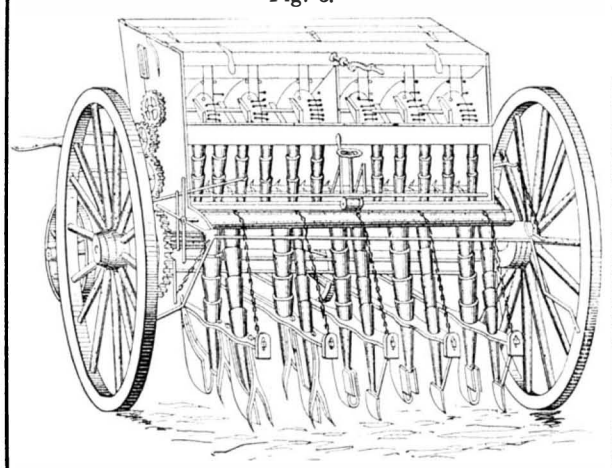
English Cultivators.

that below it is known as a skim cultivator with a long, curved, flat share, whose depth is regulated by a crank and screw.

GRAIN DRILLS

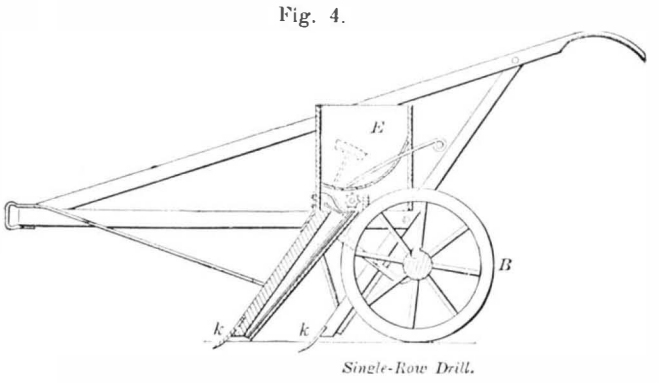
were invented by the Chinese, ages ago. Their machine is

Fig. 3.



nothing more than a wheelbarrow with a hopper for the seed and three spouts by which the seed reaches the ground; it thus drills three rows at a time. Fig. 3 is an English grain drill, adapted for performing all the various operations of seeding and manuring the land. All kinds of grain and seeds may be deposited at any required distances apart and at any depth, either with or without manure. The machines are constructed of various widths and made to deposit the seed in rows from 6 to 15 in number. Fig. 4 is a form of hand drill, mounted upon a stock resembling that of a single shovel plow. Forward is a hollow tube shod with a share and leading the grain from the box. E. A share following turns

Fig. 4.



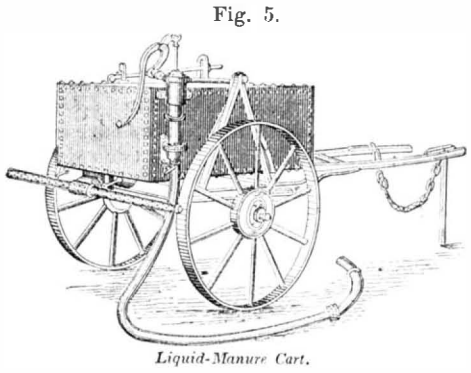
Single-Row Drill.

a furrow upon the sown grain, and the wheel, B, following, compacts the soil upon the seed. Fig. 5 is a

LIQUID MANURE CART,

which consists of a tank on wheels for the conveyance of liquid manure, to a field, for distribution. It is made of boiler iron, riveted, and is filled by means of a portable pump

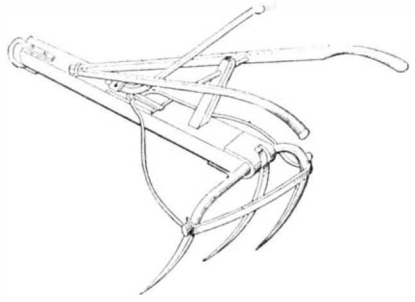
Fig. 5.



Liquid-Manure Cart.

and hose, shown in position. The tank is hung upon centers so as to remain level on inclined ground. Fig. 6 is a manure drag, an implement with hooked tines for hauling manure over the surface of the ground. It is guided by rear

Fig. 6.



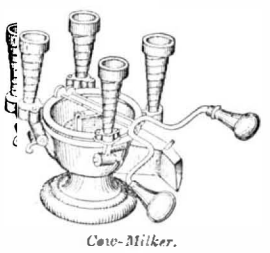
Manure-Drag

handles, and a lever is provided, to hold the tines in action or release them at will. A

MECHANICAL COW MILKER

is represented in Fig. 7. This is constructed on the principle of the breast pump, with cups for the several teats. The elastic cups communicate with the conical chamber of the diaphragm pump, the piston of which is worked by the handles. The milk is discharged by a spout into a pail beneath. Fig. 8 is a

Fig. 7.

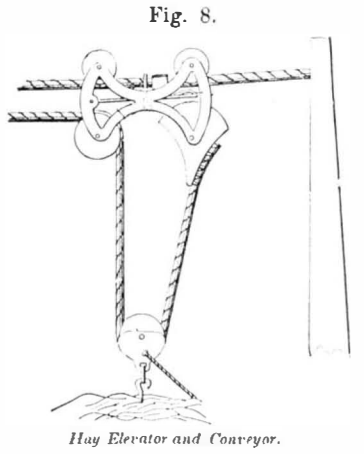


Cow-Milker.

HAY ELEVATOR AND CONVEYER

by which hay, lifted by the horse fork, is conveyed to distant parts of a barn or mow. It consists of a carriage traveling on a fixed rope and resting on rollers as shown. To one portion of the carriage is affixed the standing part of the hoisting rope, which passes down through

Fig. 8.



Hay Elevator and Conveyor.

a pulley attached to the fork, and then to another pulley on the carriage. A guide line is also attached to the lower pulley. The fork, full of hay, is first hoisted a suitable distance, and then, by slackening the guide line, continued pulling on the hoisting rope draws the carriage along the fixed rope to the desired point of unloading.

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Torsion Balance and Experimental Radiometers.

At the *soirèe* of the Royal Society, Burlington House, April 5, 1876, Dr. William Crookes, F.R.S , etc., exhibited his new devices for illustrating various phenomena connected with the repulsion resulting from radiation.

I. The torsion balance. A light beam having 2 square inches of pith at one end is cemented to a very fine fiber of glass stretched horizontally in a tube, one end of the fiber being connected with a torsion handle, passing through the tube, and indicating angular movements on a graduated circle. The whole is enclosed in glass and exhausted as perfectly as possible. A weight of 1-100th of a grain is so arranged that it can be placed on the pith or removed from it at pleasure. A ray of light from a lamp, reflected from a mirror in the center of the beam, shows the slightest movement. When the reflected ray points to zero, a turn of the torsion handle in one or the other direction will raise or depress the pith end of the beam, and thus cause the index ray to travel along the scale to the right or to the left. If a small weight is placed on one end so as to depress it, and the torsion handle is then turned, the tendency of the glass fiber to untwist itself will ultimately balance the downward pressure of the weight, and will again bring the index ray to zero. When the weight of the 1-100th of a grain is placed on the pith surface, the torsion handle has to be turned 27 revolutions and 353°, or 10,073° altogether, before the beam becomes horizontal. The downward pressure of the 1-100th of a grain is therefore equivalent to the force of torsion of the glass thread when twisted through 10,073°. One degree of torsion gives a decided movement of the index ray of light, a torsion of 10,073° balancing the 1-100th of a grain, while 10,074° overbalances it: the balance will therefore turn to the 99-100,000,000th of a grain. Weighed in this balance, the mechanical force of a candle 12 inches distant is found to be 0·000444 of a grain.

2. The turbine radiometer. In this radiometer, the vanes are black on both sides, and are inclined at an angle like the sails of a windmill instead of being in a vertical plane. The instrument is not sensitive to horizontal radia tion, but moves readily, in one or other direction, to a candle held above or below.

3. Radiometer with the vanes blackened on both sides, showing rotation in either direction according to the way the light falls on them.

4 Radiometer showing the very small amount of residual air which is present. The vanes of the radiometer move past a piece of pith suspended by a silk fiber. Rotation with great velocity scarcely causes sufficient motion of the residual air to move the suspended pith.

5. Radiometer showing rotation of the glass envelope when the vanes are held in fixed space. The radiometer carries a magnet on its arms, and is floated on water so as to be free to move. The vanes are held stationary by an outside magnet. On allowing radiation to fall on the black surfaces of the vanes, the glass envelope rotates.

6. Radiometer having inside it a platinum spiral. The repulsion of the white and black surfaces is equal when the spiral is below redness. Above a red heat the black is repelled more than the white, and rotation takes place.

7. Radiometer with one vane counterpoised by a mirror, showing method of keeping the steel point from falling off the cup.

8. Radiometer constructed of metal, showing reverse movement on cooling.

9. Bar photometer, showing the method of balancing one light by another.

10. Heat engine. A turbine radiometer, having ice below and hot air above, working by difference of temperature.

Sir John Tyndall.

Professor Tyndall, it is reported, has been offered a baronetcy, and his friends are anxious that he shall accept the honor. It is a graceful act on the part of the British government thus to recognize the labors, of the eminent investigator, but we think that it will add nothing to his glory. The aristocracy of scientific discoverers and workers is superior to one involving mere social precedence; and a man who by dint of persevering labor has attained a lofty place in the former stands far higher in the estimation of the world than does any member of nobility, however exalted his rank.

GOLD can be applied to glass by mixing it in a powdered state with mucilage and adding a little borax, so that a paste is formed. Having been painted with this compound, the article is heated in an oven. This burns the gum, while the borax vitrifies and so fixes the gold.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SIGNAL LANTERN.

George J. Cave, Elizabeth, N. J.—This is an arrangement of concentric shells and colored glass tubes, so combined that the mechanism may be readily and quickly adjusted, by a rotary movement, to display a white light, a red light, or a green, or other arrangement of colors, and which shall have no projecting arms, handles, or levers to be in the way.

IMPROVED POCKET BOOK FASTENING.

Daniel M. Read, New York city.—This inventor has devised two ingenious fastenings for pocket books. The first consists of a corrugated base plate, between which and a similarly toothed spring cap plate a double catch hook engages.

IMPROVED METHOD OF JAPANNING BUTTONS, ETC.

Charles M. Rhodes, Taunton, Mass., assignor to M. M. Rhodes & Sons, same place.—This improvement in the art of japanning small articles consists in rotating the painted articles over a fire, and in contact with the products of the combustion thereof, whereby the articles are separated, and their coating is dried, preparatory to baking them.

IMPROVED ELASTIC TRACE JOINT.

Benjamin Franklin Rea, La Fayette, Ala.—This consists of a coiled spring fastened between two sections of the trace by attaching one end to each. Inside the coil are a couple of links, also connected to the trace section, so that, when the spring has been extended as far as is desirable, they come into action and take the strain off the spring. The spring is connected to a ring at each end, and the links connect with the trace sections by a screw passing through the ring and drawing the rings against the trace sections by the links.

IMPROVED SHOE FASTENING.

Conrad Mayreis, Beardstown, Ill.—At each side of the opening a fine wire is longitudinally fastened. Metal clasps then attach the two parts together.

IMPROVED TRUSS PAD.

Charles L. Warner, Homer, Iowa.—This is an improved pad for trusses for the cure of hernia; and it consists of a pad connected to the base plate of a ball-and-socket joint, and suitable detaining devices.

IMPROVED COMBINED TOP AND WHIRLIGIG.

Reuben N. Garrett, Ballston Spa, N. Y.—In using the top as a toy, a top-shaped head is placed loosely upon the end of a pin, and the cord is wound upon the said pin, within the fork of the usual top handle. Then by pulling sharply upon the cord, the pin and the head will receive a rotary motion, and the head will be thrown from the pin, and will spin upon the floor. In using the top as a whirligig, the cord is wound upon the pin, within the fork of the handle, and by pulling upon the cord the pin and the head will receive a rapid rotary motion.

IMPROVED LIQUID COOLER.

John Downing, Binghamton, N. Y.—This consists of an ice chest in which are secured a series of jars. In the case of a water cooler the inlet pipe of the first jar is connected with the water supply pipe, and the outlet pipe of each preceding jar is connected lwith the inlet pipe of each succeeding jar. The outlet pipe of the ast jar is connected with the discharge pipe. By this arrangement the water is drawn from the last jar of the series, which is immediately replaced by partially cooled water from the next jar, and so on, the the water from the reservoir entering the first jar, so that cold water can be drawn almost continuously.

IMPROVED CLOTHES LINE.

Elias Stillwell, Rockwell, Mo.—The invention relates to means whereby a clothes line may be gradually run out from a given position convenient to the person engaged in the washing operation. This is done as it receives the garments that are to be dried, so that the washer may not be required to go far from the washroom in order to hang the clothes. It also relates to a mode of tightening the line and protecting it from the weather. Endless lines are carried over two rollers, at a suitable distance, one of which is provided with a crank, by whose aid the lines may be caused to travel back and forth.

IMPROVED PAPER BOX.

Charles A. Whedon and Asbury S. Whedon, Cranford, N. J.—This invention consists of a bandbox, constructed in a simple way of two pieces of paper, and a stand for the hat, which is also contrived so as to be made and attached in a manner to economise the cost of construction, and to facilitate its use in a folding box.

IMPROVED HAT HOLDER.

William H. Hampton, Suray, Va --The invention relates to a mode of securing a hat in church, so that the owner will no longer be compelled to hold it in his hands, place it on an uncleanly floor, or take up room on the seat with it. It consists in applying to the back of the pew a wire holder that is capable, by a rotary movement, of being carried under the seat, the hat being thus out of the way and not at all liable to become soiled or injured.

IMPROVED SIGN PLATE.

Julius Cæsar, New York city.—This is an enameled door or other plate that is secured to a metallic border frame and attached thereby to the door, without requiring the direct passage of the fastening bolts through the plate.

IMPROVED BALE TIE.

William Carson, St. Louis, Mo.—This is an improvement in buckles formed in two parts, one of which is provided with a tongue to fit in a corresponding notch in the other part. They are adapted to be locked together, and also readily disengaged by raising one part vertically off from the other.

IMPROVED LOCKET.

David Untermeyer, N. Y.—This locket is composed of pivoted parts, one holding a picture on both sides, and having opposite rims that fit over and enclose the pictures.

IMPROVED PROCESS OF PRESERVING BURIAL CASES, ETC.

Albert T. Bleyley, Conception, Mo.—This consists in coating wooden burial cases with a composition of glue, alum, saleratus, saltpeter, common salt, bichromate of potash, and water, applying thereto a second coating of glue and bichromate of potash, and a third coating of shellac, alcohol, and bichromate of potash.

IMPROVED AUTOMATIC HEAT REGULATOR FOR FURNACES.

Alvin C. Norcross, Boston, Mass.—This consists of one expanding and contracting part, and another non-expanding part, so placed in the furnace as to be subject to the heat of the furnace for working the regulator by the expanding and contracting part as the heat rises and falls. The part not required to expand is located within a tubular expanding part, having provision for a current of air to flow through it from outside the furnace to keep the other part from heating. The object is to enable a metal rod of ordinary expanding and contracting qualities to be used where a substance of non-expanding properties has been heretofore required.

IMPROVED HORSESHOE.

Henry Gourdier, New York city.—This horseshoe is so constructed that the calks may be readily replaced with new ones when required, and the calks will be held securely in place when the shoe is in use. The tongues, formed upon the bases of steel heel calks, and having projecting forward ends, are beveled and slotted to receive screws, and are caused to enter slots in the same place with the lower surfaces of the shoe.

MACHINE FOR CUTTING STAMENS FOR ARTIFICIAL FLOWERS.

Ambrose Giraudat, Neuvy (Norwood P. O.), N. J.—This is an improved machine, including a series of long, straight knives, for cutting threads into suitable lengths for the stamens of artificial flowers. It cuts the threads evenly and does its work rapidly.

IMPROVED SHOT CARTRIDGE.

Thomas Wilkinson, Brooklyn, E. D., N. Y. — This is formed by placing perforated shot upon sets of wires between two wads.

IMPROVED THILL COUPLING.

Levi Moor, Baraboo, Wis., assignor to himself and Willis B. Rich, of same place.—This is an improved device for connecting thills and poles to the axles of vehicles, so constructed as to enable the thills or pole to be easily and quickly detached without the use of any wrench or tool. A spring bar, provided with a point and a flattened bolt, is combined with a thill iron provided with the hole, and a perforated and slotted lug formed upon the yoke of an axle clip.

IMPROVED HORSE BOOT.

Joseph Fennell, Cynthiana, Ky.—This is formed with a padded upward extension, and provided with a strap and rubber tube to buckle around the heel of the hoof. The padded upper part is connected with the lower part by flexible straps made flaring upward and downward, and provided with a padded strap to buckle around the fetlock.

IMPROVED MAIL BAG.

E. Walter Roberts, Troy, N. Y.—This invention is an improvement in the class of mail bag locks, whose distinguishing feature is a chain or flexible strap, provided with a series of bolts or hangers, for engaging with a series of staples or keepers. The improvement consists in providing the bag-locking chain, formed of flat links, having hangers, or bolts, increasing in length *seriatim*, with an extension in the form of a leather pull-piece, which projects from the pocket in the flap of the bag. Another part of the invention is the construction of the sliding lock bolt, to which the aforesaid chain is attached, whereby an address card, indicating the destination of the bag and the place from which it was sent, is secured in place.

IMPROVED METALLIC SEAL.

Alphonse Friedrick, Brooklyn, N. Y.—This patent covers certain improvements upon the metallic seal for which letters patent were granted to the same inventor, March 14, 1876. To make the seal more secure, one of the disks is provided with a projecting eye or a perforated ear, through which perforation the ends of a shackle wire are passed before twisting them around the stem. This confines the branches of the shackle wire at the edge of the button, with a continuous ring of metal, and obviates the possible separation of the thin parts of metal forming the flange, and thus prevents the opening of the said flange by pulling apart the branches of the shackle wire.

IMPROVED LIGHTING ATTACHMENT FOR ALARM CLOCKS.

Frank Fischlein, Jersey City, N. J.—This is a device for lighting, simultaneously with the release of the alarm, a candle or lamp; and it consists of the connection of the alarm mechanism of a clock train, by a fulcrumed and spring-acted friction lever, that, on its release, ignites a match secured by suitable supporting and gage devices above the candle or lamp.

IMPROVED COMBINED CALENDAR AND TIME PIECE.

Miner H. Paddock, East Clarkson, N. Y.—This invention relates to the improved construction and arrangement of a calendar in a time piece, so combined therewith as to indicate the day of the week and month and the month of the year. The improvement consists in making the calendar devices independent of the effect of the main spring, so that, instead of being operated thereby, they are actuated by the hand of the operator, through the winding stem in the act of winding, by means of which arrangement the fact of the winding of the watch is indicated upon the dial face, and the question as to whether the watch has been wound or not, is easily ascertained by reference thereto. The improvements also serve to simplify the operating parts of the calendar, and consequently render its construction cheaper and its operation more reliable.

IMPROVED WHIP FERRULE.

Dexter Avery, Westfield, Mass.—This improved whip button is constructed with the braided, woven, or knitted cover of thread turned or folded over the end of the mold into the hold for the stock, so as to make a better finish of the ends than is made when the button is covered after being put on the stocks, and also to make finished buttons independently of the stock.

NEW HOUSEHOLD ARTICLES.

IMPROVED FIREPLACE FENDER.

Henry C. Wesson, Fulton Station, Ky.—This fender is contrived to disconnect at the middle or thereabouts, and swing open, and also to fold up against the jambs in a compact manner out of the way.

IMPROVED CURTAIN FIXTURE.

Michael Haughey, St. Louis, Mo.—This is a curtain fixture that is made without the use of springs. It consists of a curtain roller to which a weighted band is applied, that raises the curtain, while a weighted pawl, locking into a ratchet of the roller shaft, secures the curtain at any hight.

IMPROVED ROCKING CHAIR.

Wm. E. Buser, Chillicothe, Ohio.—This improvement relates to the application of an improved fastening or means of connection between a rocking chair and the base platform upon which it is supported and vibrated. The fastening consists of a slotted plate attached to the platform, a hook or arm attached to the rocker and working in the slot of said plate, and a spring arranged to bear upon the said hook or arm. The slotted plate attaches the chair to the platform, and also holds it in proper position thereon. The spring tends to hold the chair seat level in that it counterbalances the weight of the back, which would otherwise cause the chair to assume an inclined position. It also assists in giving the chair an easy rocking motion.

IMPROVED VEGETABLE STEAMER.

Elias Stangeland, Rock Dell, Minn.—This invention relates to a furnace and steaming apparatus for cooking grain, roots, etc., for cattle, also for heating water. It is designed for the use of farmers, livery stable proprietors, and others having the care of stock. It is portable, the several parts may be easily detached and put together, and the consumption of fuel is very economical, while the steam is so applied as to speedily produce the desired effect.

IMPROVED TACK HAMMER.

Willis C. Avery, Wallingford, Conn.—This consists of a tack hammer with a wedge-shaped pene end, having a dovetailed groove diminishing in width and depth from the body of the hammer toward the sharp edge of the pene. This offers a ready means of sticking he tack in, previous to driving it, without using the fingers.

IMPROVED TILTING CHAIR.

Alanson S. Cushing, Buffalo, N. Y.—This is mainly a novel arrangement of flanged hinged plates, rubber blocks, and springs, the whole forming a convenient and desirable device for pivot or screw chairs.

IMPROVED FIREPLACE HEATER.

Samuel Musser, Beaver Falls, Pa.—This invention relates to certain improvements in that clase of fireplace heaters which have a hot air chamber in the rear, which is employed in connection with a flue and registers for heating the upper rooms of a building. The invention consists in the particular construction and arrangements of the parts whereby the construction is simplified and a more economical use of fuel obtained.

NEW TEXTILE MACHINERY.

IMPROVED WEFT FORK.

Caleb H. Warfield, Whitinsville, Mass.—This is a novel construction, whereby the fingers are readily soldered to the arms in holes connected with a groove, so that a cheap method of securing them is obtained. They can be readily be taken out by the application of a hot iron, and others put in.

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NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED REVERSIBLE LOCK.

Edwin A. Kimball, Danville, Ill.—In this device the latch serves also as a lock bolt. The invention consists in combining with a key-holed case and shouldered bolt a double-acting guard, pivoted centrally in a recess of the bolt, having portions thereof curved and provided with projecting teeth, so as to enable the same key to lock the bolt, no matter in which direction it may be turned.

IMPROVED MOUSING HOOK.

Nels E. Johnsen, Chelsea, Mass., assignor to himself and George W. Gannaway, of same place.—The invention consists in tongued notches formed in the parts of the hook at their shoulders, and the grooved shoulders or projections formed upon said parts at their points, to adapt the parts of the hook to interlock with each other. To open the hook a spring key is withdrawn, and the eyes slipped around upon one of the arms of a pear-shaped thimble, which allows the parts of the hook to be drawn apart.

IMPROVED VEHICLE SPRING.

Thomas Alsop, Elkhart City, Ill.—This consists in combining a ratchet and pawl with springs arranged on shafts and attached at their inner ends to loose sockets. The pressure of the wagon body upon the lever arm is transmitted to the spiral spring and throughout the full length of the same to the fixed socket, the spring being called gradually but entirely into action, avoiding thereby any violent shocks and producing the easy and elastic play of the springs.

IMPROVED VENTILATING CARRIAGE AND CARRIAGE TOP.

Ezra Marsh, Newark, N. J.—This invention proposes to make close carriages in such a way that fresh air, in any desired quantity, may be admitted, and the foul air allowed to escape. The invention consists in a carriage body, having its front top bar and posts made hollow or tubular, and provided with the opening to admit fresh air to the carriage body. The latter is also provided with an air space, made by interposing a sheet of straw board between the upholstery and the walls, through which they are formed. The second invention includes a shield made in two parts, in which are glass panes connected to the sash board by swiveled eyes, so that it may be adjusted to any angle, according to the relative position of dash and top. Another new feature is a frame arranged in connection with the dashboard to hold a rug which is adapted to serve as a foot warmer.

IMPROVED DRAFT EQUALIZER.

Alexander Meharry, Pleasant Hill, Ind., assignor to himself and William Brown, of same place.—A bar is pivoted to the tongue, and to its ends are attached small chains which are secured to hook bars. From one hook bar a chain passes to a pulley on the axle, along the axle to another pulley on the tongue, thence to another pulley on the axle, and then to the other hook bar. To each hook bar a whiffletree is attached. By this construction the points of draft attachment are close to and upon a level with the forward ends of the plow beams; and by adjusting the position of the pulley on the tongue with respect to the axle, the weight of the tongue may be wholly or partly taken from the horses' necks, as may be desired.

IMPROVED WAGON BRAKE.

Jacob Hamelback, Hopewell, Ohio.—This invention relates to certain improvements in that class of wagon brakes in which the back lash of the neck yoke and the forward movement of the vehicle when the team is stopped serve to apply the brakes. The invention consists in the particular construction of devices connecting the brakes with a sliding collar, to which the neck yoke is connected; in the use of a ratchet and pawl, arranged to automatically hold the brakes applied, and to automatically release the same upon the starting of the team. It also consists in the peculiar construction of devices for preventing the application of the brakes while backing.

IMPROVED BARREL HEAD.

John W. Sasscer, Jr., Horse Head, Md.—This invention contemplates the manufacture of barrels with heads that may be readily removed without taking off or loosening a hoop, or impairing the strength of barrel. The invention consists in making an expansible barrel head in four pieces, of which two are pivoted to and over a third, while the fourth piece is employed to serve as an expanding key that retains the head tightly in its proper position.

IMPROVED DUMPING WAGON.

Jared Wells, Grand Rapids, Mich.—The bottom of the body is made in three transversely pivoted sections, each of which is connected by a chain to a pulley, and said chains pass to a shaft operated by a lever. By turning the lever the sections are tilted sufficiently to cause the load to slide from the rear ends.

IMPROVED FIFTH WHEEL.

David G. Wyeth, New Way, Ohio.—The object of this invention is to provide an improved swivel coupling for connecting the front spring and axle of carriages, wagons, and other vehicles. It consists in the construction of a sectional socket containing a bearing with two bevels which form a swivel connection between the spring and axle, and in the means of connecting and securing the parts together, the whole being designed to take the place of the fifth wheel and king bolt as ordinarily employed.

IMPROVED AUTOMATIC GATE.

William A. Baker, Morenci, Mich.—This gate is so constructed that it may be opened and closed without its being necessary for the driver to get out of the vehicle. It occupies no space outside of the line of the fence, and its operating mechanism is raised from the ground so as not to be affected by snow and frozen ground, and it closes directly behind the vehicle.

IMPROVED DUMPING CAR.

George A. Gregg, Quarry, Iowa.—The car is mounted on two grooved middle wheels running on the rails, and a single wheel on each side running on plank, by which contrivance the car may be dumped either sidewise or endwise. The middle wheels are the support when dumping sidewise, and the side wheels when dumping endwise. The sides and end of the box are so pivoted to an overhead support that they keep closed when the car is upright, and open self-actingly when the car dumps.

IMPROVED VEHICLE SEAT LOCK.

George E. Robison, Locke, N. Y.—This is an ingenious lever and clamp for fastening a seat to the body of a vehicle, in such a way that the seat can be readily moved forward or back upon or detached from the body.

IMPROVED DUMPING WAGON.

Montgomery C. and Henry L. Meigs, Romney, Ind.—This invention relates to certain improvements upon the dumping wagon for which letters patent, No. 166,125, were granted to the same inventors, July 27, 1875. It consists in a detachable skid adapted to be attached to the end of the wagon and used as an inclined way, up which the loading scoop is drawn, by means of a doubletree of greater length than the width of the wagon, the horses being attached to the ends thereof, and walking upon opposite sides of the wagon. The invention also consists in guard rails, placed upon the sides of the wagon to prevent the doubletree from deranging the devices for lifting the bottom sections of the wagon. It also further consists in a support, pivoted to the bottom of the front end of the wagon and provided with a notch which, when the end of the wagon is raised, falls upon the reach, from the action of gravity, and supports the wagon in an elevated position so as to accommodate the front wheels in short turning.

IMPROVED SAWING MACHINE.

William S. Saunders, Atlanta, Mo.—This invention consists of a portable sawing machine, containing a crank and band wheel contrivance for working the saw by a crank and pitman. The essential features are a ground hook, for holding and fastening the log, a helper for holding small sticks, and a shaft and truck wheel contrivance to facilitate the moving of the machine from place to place.

IMPROVED CAR MAT.

John W. Groat, N. Y.—The object of this invention is to furnish an improved mat for the floors of cars, saloons, and other places, which shall be simple in construction, strong, firm, and durable, and at the same time capable of being made very ornamental. This mat is formed of strips of wood which, by screw bolts carried diagonally between corner pieces and a flanged center piece, are securely fastened in place.

IMPROVED HAND CART.

Joseph M. Jones, Paris, Ky.—This inventor combines the body of a hand cart, a cranked axle, and an elliptic spring, the latter resting on the sliding frame, while the cranked axle supports it. He is thus enabled to apply the spring to take up the shock of jars and jolts without lifting up the body too high above the wheels.

IMPROVED AUGER.

William H C. Smith, Pawtucket, R. I.—This is an improved hollow auger for boring wooden conductors, being so constructed that the wood is chipped up to allow it to fall down through the auger without clogging. Bits of different size and hight are used, and there is a new way of attaching the bit to the auger by side projections, grooves, and a fastening screw.

IMPROVED CIRCULAR SAWING MACHINES

James T. Baggs, Bridgeport, O.—This invention consists of an improved arrangement of contrivances for automatically adjusting the tilting table laterally at the same time and by the same operation that it is tilted, the lateral adjustment being to shift the saw slit so as to compensate for the misplacement of it relatively to the saws, caused by the tilting. The invention also consists of a novel contrivance of the apparatus for adjusting a couple of saws on an A-shaped frame, whereby both saws may be adjusted simultaneously, or either independently of the other.

IMPROVED DUMPING WAGON.

Samuel B. Steward, Urbana, O.—By operating a lever or pinion, a shaft secured in the frame meshes into a curved rack attached to the forward part of the body. This raises said portion of the body, when, by suitable devices, the end board may be released and the contents discharged.

IMPROVED SHUTTER AND DOOR FASTENER.

Thomas B. Rogers, Jr., Brooklyn, assignor to Max Hallheimer, of same place. — A couple of bars, of unequal length, are joined together at one end. One is joined to the window and the other to the window sill, so that they swing with the blind. At the joint of the bars is a clamp by which the joint can be readily made rigid to fasten them and hold the blind in any position; and besides the clamp, there is a stud which drops into a socket in the sill to fasten the blind shut.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED NAIL EXTRACTOR.

Lorenzo D. Browne, Shawnee, Ohio.—This consists of an auxiliary claw mounted on the top of the ordinary claw bar in such a manner that it can be used when the spike is too high for the main claw, and can be swung out of the way readily when not required for use.

IMPROVED FRICTION CLUTCH.

Edwin F. Williams, Bald Mountain, Col. Ter.—This invention consists of brakes which are drawn against the face of a disk wheel by wedges moved by a sliding head on the shaft, in turn operated by the levers.

IMPROVED LEATHER-SKIVING MACHINE.

Edwin B. Stimpson, Brooklyn, N. Y.—This is a machine by which thin, light, and soft leather can be readily skived in pieces of any form. It consists of a table, which can be revolved and turned in any direction, and also raised and lowered at will, over the central portion of which is a rotary skiving cutter, a rotary presser, and a rotary guide for the leather. The leather is placed on the table, and the latter turned or moved about so as to pass the margin to be skived under the cutter. The work is effectually and rapidly performed on leather of any thickness, quality, or condition.

IMPROVED MAGNETO-ELECTRIC MACHINE.

Thomas W. Livingston, Ainsworth, Iowa.—This invention consists of straight magnets with alternating polarities, and wire coils wound in one direction, combined with a revolving shaft having at both ends as many radial arms as there are magnets. The shaft is provided with a commutator in connection with conducting springs, attached to a pivoted lateral block set by a lever into a notched plate for producing currents of uniform or reversed polarities.

IMPROVED CAR COUPLING.

John H. Lands, Reigelsville, Pa.—This consists of a pivoted link that is raised from the top side or platform of the car by a laterally swinging link frame. The latter is retained in position by a sliding guard piece with front plate until pushed back on the approach of the car to be coupled, so as to drop the link over a coupling hook.

IMPROVED CAR COUPLING.

James B. Smith, Hepworth, Ontario, Can.—This invention relates to certain improvements upon the car coupling for which letters patent were granted to the same inventor on October 26, 1875; and it consists in the improved attachment of the drawbar to the car. The rear end of the drawbar is recessed, and in the recess is arranged a box over which the drawbar slides, which box swings on a vertical pivot and constitutes the connection with the car. Upon each side of this sliding box and arranged in the recessed drawbar are disposed independent springs, which arrangement enables the buffer spring to be made stronger or lighter than the draw spring, as may be desired.

IMPROVED NUT LOCK.

George E. Jordan, Angola, Ind.—This inventor proposes a continuous strap or plate with slots or recesses for several nuts, said plate being secured by washers and keys at the ends.

IMPROVED GOVERNOR FOR STEAM ENGINES.

Christ Ackermann, Young America, Minn.—This improvement consists in the peculiar construction of parts whereby the connection between the valve and the balls of the governor is broken whenever the belt breaks and the balls drop, so that the valve automatically closes as soon as the accident occurs, and the speeding of the machinery is prevented by cutting off the steam.

IMPROVED BOAT-DETACHING HOOK.

Robert McMaugh and Archibald McMaugh, St. Catharine's, Canada.—This consists of a pair of hooks, surrounded at the middle by a pivoted loop which ordinarily holds them closed. The loop is held in place by a pin entering one part of the hook and being held there by a spring. A cam arrangement is added, so formed that, when it is turned to bring its lever upward, it may force outward the spring, withdrawing the pin from the hook and allowing the loop to be raised.

IMPROVED COKE OVEN.

Sebastian Stutz, Pittsburgh, Pa.—This improvement consists in the arrangement of zigzag passages below the bottom of the coking chamber and upon the sides between the inner and outer walls whereby a more uniform heat may be maintained, and also in the employment of a reservoir for the collection and utilization of the waste gases.

IMPROVED MACHINE FOR CUTTING BOOT STRAPS

John E. Plummer, Hornellsville, N. Y.—This invention is designed for cutting boot straps, but is applicable also for cutting straps used in harness, trunk, and saddle making. It consists in a framework carrying a revolving shaft having a leather holder provided with a set of automatically operated clamping fingers or springs, which clasp the leather to a holder, in combination with a stationary knife which, as the leather holder revolves, cuts off the length of the strap, and a series of stationary knives which sever the cut section of leather into a series of straps.

IMPROVED PACKING FOR CAR AXLE BOXES.

I. Benedict, Richmond, Va.—This invention relates to means for packing the axle boxes of cars and other vehicles so as to furnish a gradual supply of lubricating material to the journals, and consists in the application of cork or analogous substance, so that oils of a liquid character only at ordinary temperatures may be as readily employed as those that assume a more solid form, and so that the boxes may be safely manipulated even by unskilled persons.

IMPROVED GUARD FOR RAILROAD CROSSINGS.

Lyman L. McCrea and Robert V. Coon, Troy, N. Y.—This is a device for preventing horses' feet from getting caught upon the spike heads, or between the rail and planking, at railroad crossings. It consists in a guard having one edge formed to fit upon the flange and into the neck of the rail, and its other edge formed to fit against the edge of the planking. It is concaved upon its upper side, and provided with a flange and lugs to underlap the planking and the flange of the rail between the ties.

IMPROVED DIE FOR MAKING HAMMERS.

Henry W. Kip, Buffalo, N. Y.—This invention consists of dies contrived in a novel way for shaping, riveting, and other like hammers, and punching the eyes in a drop press at one blow, and also partly separating them from the rod.

IMPROVED BELTING.

John Neumann, Brooklyn, N. Y.—This consists of broad metal links with notches in the ends, forming loop-shaped projections for interlocking. The projections of one are arranged in the notches of the other, and a couple of pins are inserted and so arranged that they roll one on the other when the chain bends around the pulleys. Sliding friction in the connection of the links is thus avoided. The invention also consists of plates attached to the sides of the link to adapt the belt for grooved pulleys. Said plates are so arranged as to fit the sides of a tapered groove, and have a little flexure in the connection with the links, so that they accommodate themselves to the sides. These plates are connected to the links in a simple and inexpensive manner, which also constitutes a part of the invention.

BUTTON-SEWING ATTACHMENT FOR SEWING MACHINES.

John W. Fries, Salem, N. C.—This consists of a clamp for holding the buttons under the needle arranged on a shifting plate, which is worked to right and left alternately with the operation of the needle by a little vibrating cam on an elbow lever worked by the needle bar, and which is itself vibrated by the plate which carries the clamp.

IMPROVED PUMP.

John K. J. Foster, Horbury, near Wakefield, England.—This consists in constructing the displacer in the form of a hollow cylindrical sheet metal vessel, with a tube running through the same longitudinally, so that several of the displacers may be placed upon the same pump spear, if desired.

IMPROVED BURNISHING MACHINE FOR BOOTS AND SHOES.

George E. Burgess, Hudson, Mass., assignor to himself and Waldo B. Brigham, same place.—This consists of a rotary burnishing tool, constructed in conical form to fit the beveled shape of the edges of shoe shanks, and having a head which fits the upper edge. The head at the same time constitutes a guide, by which to aid the operator in applying the shoe to the tool. A friction pad is combined with the tool, to afford the heat necessary to the efficient action of the tool.

NEW AGRICULTURAL INVENTIONS.

IMPROVED MILK COOLER AND STRAINER.

Charles Weineis, Bloomingdale, Ill.—This is an improved milk cooler and strainer, by which any quantity of milk may be cooled in quick and effective manner for transportation, the cooler allowing also the ready detaching and cleaning of the parts. The invention consists of an outer water receptacle, a milk receiver, with bottom strainer and threaded tube screwing into the bottom tube of the outer receptacle, and of an interior cooling can, with spiral winding rib, forming the channel for the milk to pass through to he outlet tube.

IMPROVED BEE HIVE.

Caleb E. Bost, Davidson College, N. C.— This invention relates to an improved construction of bee hive designed to give greater security to the bees from the attacks of moths and millers, and which shall be more convenient in handling and better adapted to promote the health and prosperity of the bees in all seasons. It consists in the construction and arrangement of the entrance to the hive for keeping out moths and millers, and in a supplemental upper section for the hive, which can be taken off or placed on according to the requirements of the season.

IMPROVED RAKE.

Glover Hawley, Hawleyville, Conn.—The object here is to make rakes that have become loose upon the handle as firm and strong as new ones. A plate of wood or metal, made wider at its forward end, and with two holes to receive the middle teeth, is secured to the handle and head.

IMPROVED WEANING BIT FOR CALVES.

John H. Bailey and Louis Loupee, Toledo, Iowa.—This is an improvement on the anti-sucking bits for calves for which letters patent have been granted to John H. Bailey, under date of November 9, 1875, so that the animal has a better chance to eat and drink without covering up the ends. The invention consists of a tubular suction bit, which is made of two centrally hinged sections, open at the ends, which rings are attached to stationary staples projecting toward the rear of the bit sections.

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The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export & Domestic Use. R.H. Allen & Co., N.Y.

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To M'f'rs and Machinists—Parties desiring Self-Feeders attached to Machines formerly Fed by hand, or Improvements otherwise, address Inventor, Box 773, N. Y.

Trip Hammer for Sale Cheap—100 lb. Head. Has never been used. Also Watt Steam Hammer, 1500 lb. Head. Used about two years. Address Edgar L. Kinsley, Cambridgeport, Mass.

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Patented Invention of real merit wanted—No notice taken unless particulars specified. Address A. E. H., Station G, New York City.

The Photo-Engraving Co. have been obliged to remove from 62 Courtlandt St. to a larger building at 67 Park Place. Their Relief Plates for Newspaper, Book, and Catalogue Illustrations are rapidly taking the place of Wood Cuts and are unsurpassed. See advertisement in another column of this paper.

Wanted—A Marine Engineer, with some capital for partnership to a valuable invention. A great fortune is offered to a speculative man. Address to J. Ch., P. O. Box 202, Bristol, Conn.

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The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to ¼ horse power. Agents wanted. Address, with stamp, 1113 Chestnut St., Philadelphia, Pa.

Parties manuf'g Door Knobs to Order, send address to W. H. Gonne, Architect, Chatham, Ont., Can.

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Machinist's Tools, second hand, which must be sold in order to close up an old partnership. For pamphlet, giving full description of each tool, address Steptoe, McFarlan & Co., 214 West 2nd St., Cincinnati, Ohio.

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For 2nd Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

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For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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All Fruit-can Tools, Ferracute W'k's, Bridgeton, N.J.

Wind Mill Rights Cheap—One county in each State to give for introducing the mill. For terms, &c., address E. S. Smith, Good Hope, Ill.

Notes & Queries

A. K. will find, on reference, that the perpetual motion absurdity in most of its forms is discussed in vols. 23 and 24.—R. J. will find formulæ for calculating the strength of boilers on pp. 116, 165, vol. 28.—F. W. can nickel plate iron castings by following the directions on p. 235, vol. 33. J. S. can clean marble by the method detailed on p. 330, vol. 32.—J. W. H., J. C. W., C. S., F. J. M., J. D., R. M., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. M. C. says: We have an engine 7½ inches diameter by 20 inches stroke. The steam ports are 4 x ¾ inches, with a 1½ inch steam pipe. We use 60 lbs. steam boiler pressure, cut-off at ⅝ stroke, and run at 150 revolutions per minute, using ¾ to 1 cord hard wood per day. We have written to a firm in regard to a governor for the same, and have received a reply that the steam pipe should be not less than 2½ to 3 inches, as the steam now has to travel through 1½ inches pipe at the rate of 15,000 feet per minute, to keep up with the piston. Is this so? A. The steam pipe is too small if you wish to get full power out of the engine. Under the circumstances, it seems to be large enough, and you could probably carry a lower boiler pressure, and open the throttle a little more.

(2) C. C. E. asks: What time of the year is best for cutting oak timber for fence posts? A. There is some difference of opinion on the subject, but we think the weight of authority is in favor of cutting the timber in spring or autumn.

(3) C. L. M. asks: 1. What proportion has the focus of field lens of an Huyghenian negative eyepiece to the eyeglass, as used in compound microscopes? A. The field lens has about double the focal length of the eye lens, and their distance apart is one half the sum of their focal lengths. 2. What proportion has the aperture to the focus? A. The aperture of each is one half the focal length.

(4) W. O. asks: During the first quarter revolution of the driving wheel of a locomotive (the wheel pressing upon the rail), does the point in the circumference marking the exact top thereof move a greater distance forward than the exact bottom of the same? A. Yes.

(5) W. G. says: I have tried zinc in my boilers for preventing incrustation, and find it very good. I wind strips of copper around it. I put in a 3 feet by 10 feet boiler about 20 lbs. in 3 to 4 lbs. ingots. I put some on the bottom, and some on top of the flues, near the heads.

(6) M. B. M. asks: 1. How much water would Montgolfier's hydraulic ram discharge at the spindle valve in raising 100 gallons 25 feet above the supplying fountain? A. It would depend on the head and the efficiency of the ram. 2. Would it discharge any more at the spindle valve to raise the same amount 50 feet high? A. Yes, other things being equal.

(7) J. H. H. says: Our town is situated on a limestone rock bed, with a river running through it; and when the water runs over the dam, the windows and doors of the houses within a quarter of a mile of it shake. Is the shaking caused by the water falling on the same strata of rock that the foundations of the houses stand on, or by concussion of the air caused by waves, etc.? The fall of the water is about 12 feet. A. We incline to the first hypothesis.

(8) C. G. B. asks: How much water is evaporated from a pond of given area (say 100 by 300 yards) in the course of a year, and how much daily in warm weather? A. In general practice, the average evaporation per 24 hours is taken at $\frac{1}{100}$ of an inch in depth. This only gives an approximation for estimates. Of course, for any particular locality, it must be determined by experiment.

(9) H. F. S. asks: Would two half circles of round iron, 1 inch in diameter, placed in curved slots made to receive them, bear a sudden and great force, tending to separate two blocks connected by them, without straightening? A. Thus arranged, they would form a very strong connection.

(10) I. L. B. asks: 1. What effect is produced on the temperature of air by its being compressed? A. It is increased. 2. Is this effect intensified by the extent of compression? If so, what is the law? A. See p. 123, vol. 33. 3. How much can air be compressed? A. It is only limited by the strength and durability of the machinery. 4. What would be the effect of heating or cooling air, when compressed, after it is permitted to expand? A. Heating increases, and cooling decreases, the volume or the pressure. 5. Has any automatic device been contrived by which air can be compressed, so as to give it an expansive power of two or more atmospheres, and where can a description of such device be found? A. There are numerous machines of this kind. You can obtain descriptions from nearly any dealer in machinery.

(11) D. C. S. asks: 1. Is zinc paint as good as oil paint for the outside of a boat where it will come in contact with the water? A. Our experience, which is, however, quite limited, is rather against the use of zinc paint under such circumstances. 2. What is the best composition to use in cleaning the brasswork on a boat? A. Bath brick with oil answers very well. 3. What composition is the best to put on ironwork of a boat to give it a smooth black surface that will last? A. Black varnish made from petroleum is very good.

(12) H. M. W. says: 1. I am making a small engine, with a cylinder 1⅛ x 3 inches. What should be the size and weight of fly wheel? A. Make it 10 inches in diameter, to weigh 12 or 15 lbs. 2. I wish to make a horizontal boiler 14 inches in diameter and 2 feet long, with a flue 8 inches in diameter, using the flue for a fireplace. Would this leave sufficient water space? A. Yes. 3. Would cast iron heads do? A. We do not recommend their use.

(13) J. J. says: 1. You state that some kinds of cast iron become casehardened to a high degree by friction and wear. Is there any particular mixture of cast iron that will become thus casehardened? A. All cast iron casehardens by friction. The harder the metal is, the more it casehardens. 2. Is there any known method of casehardening either wrought iron or cast iron by the application of any substance while in motion? A. No.

(14) H. P. M. asks: I am making a pair of engines with live steam jackets on cylinders. Is there any better mode of effecting economy by preventing radiation? A. Steam jackets are advantageous in some cases, and in others it is doubtful whether their use is beneficial. Much depends upon the conditions under which the engine is operated, and more, probably, upon the design and management of the jacket.

(15) L. H. F. says: 1. We often see, in the morning and evening, when the sky is partly clear, streaks running to or from the sun. What causes them? A. They are caused by a portion of the sun's rays passing through openings in the clouds, while the adjacent portions are obstructed by the clouds. 2. Why does more snow fall after sunset than during the day? A. The heat of the sun retards its forming. 3. Some say that a noon mark for the summer season will not do for winter, that the sun is farther west. Is this true? A. There are but four times in a year in which the sun will be on the noon mark at noon. These are April 15, June 14, August 31, and December 24. The sun is either fast or slow the rest of the time. 4. What causes a circle around the sun? A. These are called parhelia, and are caused by the sun's light being refracted by moisture or frost in the higher portions of the atmosphere.

(16) H. J. W. asks: Is there any acid that will burn iron plating as deep as ⅛ an inch or more? A. You may try a hot mixture of muriatic and nitric acids with water. We do not, however, think that any method of this kind will prove very successful.

(17) J. H. H. asks: Does the virtue of gypsum for fertilizing land consist in the amount of sulphuric acid combined with the lime? If so, how can I determine the relative amount of acid in two different parcels? A. It is generally believed that the favorable action of gypsum upon vegetation is due to the absorbed ammonia which is yielded up. Putridity gives rise to the formation of carbonic acid, which combines with the lime of the gypsum, leaving carbonate of lime and sulphate of ammonia. This explanation of the efficacy of gypsum-dunging, as it is termed, is however insufficient. The investigations of Mayer have shown that in clayey soils the oxide of iron, etc., affords larger and better combinations with ammonia than gypsum. The quantity of gypsum used is about 5 cwts. to the acre, containing and realizing at the most $2\frac{7}{10}$ cwts. of carbonate of ammonia. Mayer's researches, however, show that in an acre of field land there are 272, and in chalky soil 158, cwts. of carbonate of ammonia contained. According to Liebig's late researches (1863) it appears that the gypsum gives up to the earth a portion of its lime in exchange for magnesia and potassa. But it must be borne in mind that pulverized gypsum, as well as unburnt gypsum, when brought into contact with a solution of potassa, sets into a difficultly soluble mass. We must, then, wait for an adequate theory until the several reactions have been more closely studied.

(18) C. R. C. says: I wish to convert waste silk into its raw state. How can it be done? Being twisted, it is almost useless. Is there any chemical process by which the twist may be disengaged and the substances converted into floss? A. We know of none.

(19) C. A. B. & B. ask: How can we make a waterproof glue, solid and tough at ordinary temperatures, but which can be softened by heat? A. Melt together in an iron pot equal parts of pitch and gutta percha; apply while hot.

How can we make artificial camphor, described by Dr. Ure? A. Transmit the dried hydrochloric acid gas into the artificially cooled essence of turpentine so long as it is absorbed. As soon as this absorption ceases, the compound must be submitted to the action of a freezing mixture of snow and salt, by which it is separated into two portions, one of which crystallizes while the other remains liquid even at 0° Fah. The production of the liquid compound is favored by elevation of temperature. If the temperature of the essence be raised to 212° Fah. during the absorption of the hydrochloric acid, the liquid compound only is formed. Both the solid and the liquid are found, on analysis, to possess the same composition. The solid body has been termed hydrochlorate of camphene or of dadyl. It crystallizes in white prisms, which have an aromatic smell and taste resembling those of ordinary camphor. It is insoluble in water; alcohol dissolves one third of its weight of it. This artificial camphor melts at 239° Fah., and boils at 329°, at the same time undergoing partial decomposition.

(20) H. L. asks: How can I make gasoline, for burning in a stove which I am constructing? A. Gasoline is obtained as a product of the distillation of petroleum. It is among the lightest oils that come over on the first application of heat, its volatility and inflammable nature rendering it a dangerous substance in inexperienced hands. It would be cheaper and safer for you to purchase one of the stoves in question, and with it explicit directions for its manipulation, rather than attempt the construction of one from any directions that we could give you. This answers several other correspondents.

(21) A. B. says: We are using inkstands made of zinc plate, but the ink will not keep in them, as the logwood falls to the bottom, and above is clear water. How can I remedy this? A. The common metals are not suitable for the construction of inkstands, no matter what variety of ink is employed. Glass vessels are the best and most economical.

(22) S. P. says: I desire to get a light (from an oil lamp or a coal gas flame) that has no chemical activity or actinism whatever. I understand that a yellow light has no such activity, and that photographers use a yellow light in their dark rooms without its exerting any apparent effect on the negative. How can I do this? A. The actinism of lamp or gas flame is almost imperceptible. Such light is of itself of a yellowish cast, and does not require the colored glass you mention.

(23) J. P. O. asks: What chemical will destroy tinfoil without soiling paper or eating it up? A. Try mercury.

(24) W. J. F. says: Please give me a formula for protoxide of iron. Can it be made by any other method than passing dry hydrogen over the red oxide? A. Yes. The monoxide is thrown down from its solution as a bulky, whitish hydrate, by the addition of a little solution of potassa; it soon becomes brown, however, if allowed to remain in contact with the air, by the absorption of oxygen.

(25) C. D. M. asks: Can dynamite be diluted to a degree that it will lessen its explosive properties, so that it can be experimented on by inexperienced persons without danger of serious results, and at the same time retain its characteristics so that its actions may be understood? A. Such experiments could not possibly be made free from danger. The dilution you suggest is not practicable.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

D. F. M.—It contains no silver.—J. C. H.—The inorganic constituents of the sample are alumina (considerable), potassa, soda, lime, and traces of iron and strontia. It would require a complete analysis to determine the organic constituents, which form a very considerable portion of the substance.—W. R. F.—No. 1 is gum of *artocarpus incisa*. We cannot say whether this contains any injurious matter or not; but many of the gums of the same species have acid and intensely poisonous properties. We cannot classify No. 2 without an analysis. Nos. 3 and 4 are Florida beans.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Telescopic Eye. By J. H. H.
On the American Flag. By C. E. N.
On a Boat Protector. By A. M. G.
On the Confederate Banner. By S. D.
On Canine Sagacity. By S. S. M.
On the Flow of Liquids. By C.
On the Erie Canal. By W. J. A.
On a Picno-Hydrometer. By H. W.
On the Wear of Railway Rails. By J. L.
On a Torpedo Experiment. By A. B. R.
On a Remarkable Egg. By J. McM.

Also inquiries and answers from the following:

B. B.—E. L. L.—A. M. S.—G. B. R.—P. B.—J. K.—T. B.—N. W.—J. W.—O. A.—T. R. V.—G. W. S.—C. S. C.—H. S. R.—D. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes air pumps? Where can steam engine indicators be bought? Whose is the best pressure gage? Who sells detonating railway signals? Who sells plate friction electrical machines?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 11, 1876,

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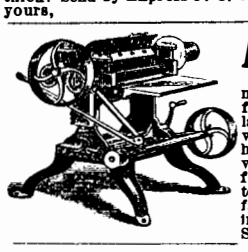

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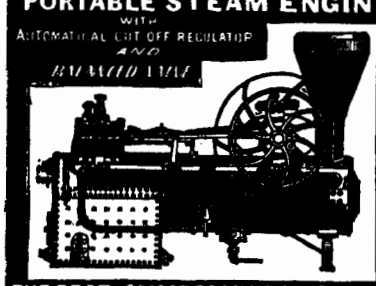

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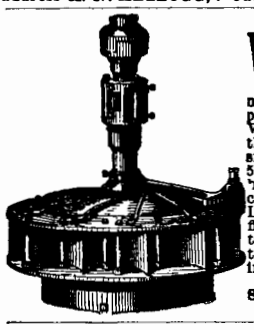

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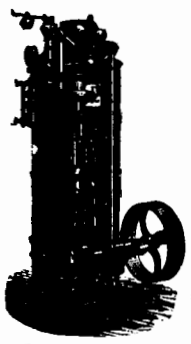

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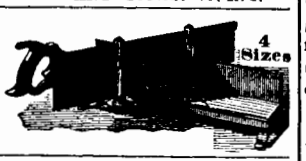

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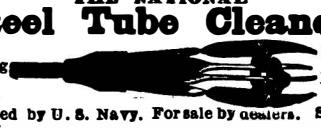

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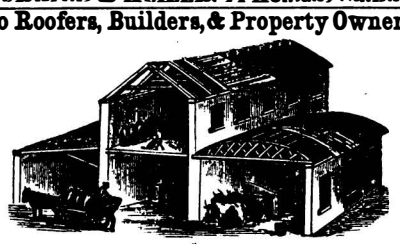

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